FIELD CROP ABSTRACTS

Vol. 12 November, 1959 No. 4

REVIEW ARTICLE

A REVIEW OF RECENT RESEARCH ON THE AGRONOMY OF FIBRE FLAX

BY

P. SONNE FREDERIKSEN

(Institute for Research on Commercial and Industrial Plants, Kolding, Denmark)

The increase in the scale of fibre flax cultivation in Western Europe and overseas territories of the British Commonwealth (52, 104) has led to a similar increase in the amount of research devoted to the cultivation, harvesting and diseases of the crop. The purpose of this review is to present a summarized and necessarily brief account of the important achievements in the field of research on the husbandry of fibre flax. It must be borne in mind that between 85 and 90% of the total area under fibre flax is situated in the USSR and other eastern European countries, and that these countries produce 80–85% of the world fibre output. Research work of a comprehensive nature is in progress in these countries, but the results are known only to a limited extent to the author and, for this reason, provide only a small part of the information on which this review is based.

THE BOTANICAL CHARACTERISTICS OF FIBRE FLAX

The amount of work that has been done on the origin (84) and morphological characteristics (82, 83) of fibre flax is limited. It has been shown that fibre flax belongs to the Asiatic-European group of flax types, which are characterized by their small seed.

Morphological investigations on the structure of the flower and the genetics of flower colour have been conducted at H.M. Norfolk Flax Establishment, in England. Extraction and paper-chromatography techniques have shown that petal colour is due to the presence of anthocyanins. The normal blue colour which occurs both in oil-seed- and fibre-flax is probably a delphinium monoglucoside ; the diglucoside is not present.

The anatomy of the flax plant and, in particular, the formation and structure of the fibre bundles, is well known from the classical studies of Herzog and Tammes but in recent times relatively little work has been done in this field (12, 26, 27, 42, 91). The techical flax fibre extends from the cotyledon leaves at the base of the stem to the seed capsules at the top, and consists of bundles of fibres laid down during stem growth. Branching of the fibres is directly proportional to the number of leaves per unit length of stem and the greater the distance between leaves, the smaller is the amount of fibre branching. The formation of a leaf results in the interruption of a fibre bundle and fibre growth is continued by further cell division.

An individual fibre bundle consists, in cross-section, of 10–25 fibres joined together by pectic substances (80) and lignified cross-linkages, which endow the fibre cells with a greater capacity to remain joined together in a bundle than the cells in the epidermal tissues. The structure, the ratio of cell wall to lumen, and the cross-section of the fibre cells are of primary importance to the research worker, and, in present-day breeding work in Gt Britain, have been used as the basis for the selection of new varieties (96). The cross-sectional configuration of the fibre is of great importance for the separation of the fibres during hackling. The walls of the fibre cells are composed of three concentric layers ; each layer has a spiral structure, but the direction of twist of the spiral in the outer and inner layers is opposite to that of the middle layer (91).

Stem configuration greatly influences fibre quality. The highest relative fibre content is found in stems which, under given cultural conditions, have the smallest diameter associated with the greatest technical fibre length (27). By its influence on these characteristics, plant population affects fibre development and quality.

THE BREEDING OF FIBRE FLAX

Very substantial developments have taken place in the field of fibre-flax breeding during the last 30 years (88). Two centres, Wageningen in the Netherlands (18) and Norfolk in England (96), have been of particular importance in this respect.

Dutch breeding work has been based on the white-flowered flax selected in 1816 from the types of flax then grown about the Baltic flax centre of Riga. Under the leadership of Prof. J. C. Dorst, a long series of varieties has been introduced into cultivation, including Concurrent, Diana, Solido, Noblesse and Wiera. Among these, Wiera is the most recent and has given outstandingly high yields (5, 17, 37, 62, 66) for which reason it is produced in all flax-growing areas outside the USSR and, indeed, is often the only variety in use.

Dutch fibre-flax varieties are mostly white-flowered, very stiff-stemmed (20, 97), give good

seed yields (32) and are resistant to disease, but the fibre is relatively coarse and less easy to spin than that of the old Baltic flax types, or of the English Liral and Norfolk types. Flax breeding in England, led by G. O. Searle (96) first at Lambeg, N. Ireland, and later at King's Lynn, was based on blue-flowered types and led to the production, among others, of the varieties Liral Crown, Liral Prince, Norfolk Queen, Norfolk Earl and Norfolk Mandarin. These have been grown almost exclusively in Gt Britain (72) and the British Commonwealth. They have been scientifically bred, have outstanding fibre quality, but lack stem-stiffness and resistance to disease, for which reason they are little used in the fertile West European flax-growing regions.

GENERAL CULTURAL REQUIREMENTS

The successful culture of flax requires that certain demands be fulfilled in regard to the fertility, structure and moisture-holding capacity of the soil.

WATER REQUIREMENTS

German and British workers (70, 94) have shown that fibre flax uses a greater volume of water per kg. of dry matter produced than barley. Water consumption is greatest during the period of stem elongation, which lasts for the period between 20 and 60 days after emergence. The increase in stem length can amount to as much as 5 cm. daily during this period ; lack of moisture at this time can limit fibre extension and adversely affect fibre formation, while lack of water at the start of flowering may severely reduce seed yields.

SOIL REQUIREMENTS

The high water requirement of the crop (70, 78, 86, 94) limits its cultivation to regions with a relatively high rainfall and soils with a satisfactory capacity to retain moisture. During the post-war period the cultivation of fibre flax has not infrequently been extended to new districts without due regard to its requirements as to soil and moisture. In some countries, including Sweden and Denmark, any extensions in the area under fibre flax have been confined only to suitable soils. The requirements of fibre flax with regard to soil are, as much as anything, to be equated with soil structure, especially that of the seed bed. The seed will not tolerate adverse conditions during germination and fails to emerge satisfactorily from depths greater than 2·5 cm. A homogeneous plant stand can only be secured where the soil structure also is homogeneous.

PRECEDING CROPS

In all western countries, cereals or other crops which do not cause an accumulation of N in the soil are used to precede flax. The question of which previous crop to use is bound up with the fertility of the soil, especially its content of available N, which should be so regulated that the best possible conditions for stem elongation and maturation of the crop are secured. Pests and diseases which may winter in the soil or which include both fibre flax and other crops in the rotation among their host plants must also be taken into account.

Probably the best preceding crop is oats taken after a clover/grass mixture (59). In all important flax-growing districts the area under oats is falling, partly because of the declining number of horses on farms. This means that, to an increasing extent, flax must be grown after other crops ; in Denmark, for example, it may have to follow barley, which, like flax, is a host plant for thrips (*Thrips angusticeps*).

MANURING

The well-known precept that fibre flax should only be grown on inherently fertile soil has in recent times been abandoned almost everywhere in favour of a scientifically-based use of artificial fertilizers (99). Flax is a crop with a high requirement for K and, except where the soil is inherently rich in this element, will only give its best yields where a substantial amount of K has been applied. In Denmark it has been found profitable to apply as much as 100–150 kg. K per ha. provided that it is applied during the previous autumn, so that the winter rainfall can leach it into the rooting zone ; this is especially important in the case of muriate of potash (29, 30, 48), the chloride ion of which may injure the crop unless it has been leached out of the root zone.

Applications of potassium sulphate in spring are tolerated well by flax (36), but may remain in the surface layer of soil and so be unavailable to the crop during the subsequent growing season. This is particularly important in the case of flax, which undergoes stem elongation in early summer. In some circumstances, Na can replace K for fibre flax (48, 63). The relationship between N and K in the metabolism of plants has been well established by research carried out especially in Germany. The highest possible yield can be secured only where these two elements are present in the correct proportion (12). Recent Danish field trials have shown that fibre flax responds better to nitrate N than to ammonium N (35) because the former is taken up more rapidly by the crop and also the greater availability of nitrogen favours a higher rate of K-uptake. On clay-loam soils in Denmark, a N : K ratio of about 1 : 3 is recommended.

The amount of P applied varies more from country to country than does that of K. Under conditions of intensive farming in which large amounts of P are supplied to the soil, fibre flax shows little response to added P and indeed may

actually suffer damage (30). This rule does not, however, apply to the extensive reclaimed areas in the Netherlands, Belgium and other countries, where superphosphate is often used in greater amounts than K and N fertilizers.

It is estimated that the amounts per hectare of the 3 major nutrient elements taken up by fibre flax are 50–75 kg. N, 10–20 kg. P and 50–70 kg. K, where crop yields are of the order of 6–7000 kg. straw plus seed per ha.

SOWING

The best fibre quality in the individual fibre-flax plant is produced under conditions of high plant population, which tends to restrict branching and to extend stem length at the expense of stem thickness. The number of plants per unit area greatly depends on such factors as soil conditions, sowing rate and quality of seed (16, 25, 31, 38, 40, 56). The sowing rate normally varies between 80 and 180 kg. per ha. according to the region where the crop is grown. Experiments on sowing rates have been conducted in many countries (3, 4).

In most countries, the seed is now drilled, often with very close row-spacing. In the Netherlands, e.g., a row-spacing of 8–9 cm. is used. Examples of countries where the seed is broadcast are Japan and N. Ireland. The effectiveness of broadcasting as a method of sowing depends on the tillage preparations and rainfall during the sowing period. Theoretically, broadcasting gives the ideal plant distribution and for this reason coulter drills have been devised (44) which produce a scattering of the dropped seed. Coulter drills have been tested in Denmark (59), as well as in other countries, but they have not come into general use. For satisfactory results when using the coulter drill, a seed-bed with a very uniform soil structure is needed and the method frequently results in uneven seed cover. Russian trials have shown that good results can be obtained by using devices for regulating the depth of the drill coulter, and that the speed at which the drill travels is also of importance.

Sowing-date trials in several countries (96) show that, generally speaking, flax is best sown at the same time as spring-sown barley and oats. It is important that there should be sufficient soil moisture to ensure germination and that the crop should not be exposed to drought during the period of stem elongation.

SEED TREATMENT

Fibre flax is attacked by a number of seed-borne diseases (11, 28, 49, 55, 67, 74, 75, 76, 83, 93, 95), which in the past have been obstacles to its cultivation.

As the incidence of these diseases is greater in regions of high rainfall and high humidity, the production of seed for sowing was restricted in these climates, and to maintain disease-free crops, seed was in former times almost invariably imported from regions with a dry climate (hence the popularity of seed from the Riga district).

Developments in the field of fungicidal seed dressings over the last 30 years (8, 55, 100, 102) have made it possible to produce healthy seed in regions in which the crop is grown for fibre. Muskett and Colhoun, working in N. Ireland, have been pioneers in this field (11, 74). During the post-war years, they experimented with TMTD ; this fungicide has subsequently been tested in many countries and its use has now become universal. It is acknowledged to be the best seed disinfectant for flax by virtue of its lack of mammalian toxicity, its capacity to stick to the seed, and its effectiveness against *Polyspora lini*, *Colletotrichum linicola*, *Botrytis cinerea* and other pathogens. Recent investigations (105) have indicated that preparations containing mixtures of TMTD and Hg compounds are more effective than TMTD alone. The same applies to mixtures of TMTD and lindane (gamma BHC preparations), even though the effect of lindane is almost entirely confined to controlling insect pests, especially flax flea beetle, immediately after emergence.

Dust preparations are normally used, but liquid seed treatments have been effective in trials and are now in use to some extent. The Swedish fungicide panogen has given good results. Liquid seed treatments result in the closest contact between fungicide and pathogens in or on the seed coat. However, unless the seed is to be sown immediately after treatment, it must be dry enough to be able to absorb the amount of liquid applied without exceeding a moisture content of about 12%, above which level the seed may suffer a reduction in viability when stored. Any measures which ensure that the crop is grown under the best possible cultural and manurial conditions will also endow it with some capacity to withstand diseases (10).

WEED CONTROL

Fibre flax is very sensitive to weed competition and the quality of the harvested fibre is reduced when it is mixed with weeds. The hand-weeding of former times has been succeeded by chemical weed control in all countries, though hand-weeding still persists in Japan and some regions of eastern Europe. Though a dicotyledonous plant (34), flax nevertheless shows a high degree of resistance to certain herbicides, which makes it easier to use these herbicides for controlling weeds in the crop (7, 9, 11, 89).

Among the various cultural problems associated with flax, that of weed control has received the greatest attention during the last decade. Comprehensive field trials, especially in Scandinavia and the Netherlands (33, 39, 81), have

shown that herbicides of the DNC, MCPA, and dinoseb types can be used, provided they are applied when the crop is 5–8 cm. tall and that the weeds have reached a suitable stage of development. Immediately after the last war, investigations in Scandinavia showed that mixtures of the Na salts of DNC and MCPA were more effective than either used singly and did not result in increased crop injury (33). Control of weeds with pure MCPA is practised in many countries, whilst the use of the ammonium salts of DNC and dinoseb, commonly employed in the Netherlands and other countries, has diminished.

PESTS AND DISEASES

The only insect species which cause any noteworthy damage to flax are the flea beetles *Longitarsus parvulus* and *Aphthona euphorbiae* and thrips (*Thrips lini* and *Thrips angusticeps*) (23, 24). Flea beetles feed on the leaves and stems of young plants and can be controlled by DDT and parathion dusts or sprays. Thrips attack the tops of plants, where the adults and larvae suck the sap from leaves and stems ; best control is with parathion, preferably as a spray. Other insect pests occur sporadically, including silver Y moth, (*Plusia gamma*), capsid bugs (*Calocoris norvegicus* and *Lygus pratensis*), *Tipula* spp., the tortricoid *Conchylis epilinana* and the leaf miner *Phytomyza atricornis*. Control of these species is not usually necessary.

Seed-borne diseases (8, 15, 45, 85) are effectively controlled by seed treatment (see p. 261). Flax rust (*Melampsora lini*) has been pushed into the background by breeding for resistance to it (13, 14, 53), on the basis of the work of H. H. Flor (21, 22). Beet mosaic has been observed on flax (41). Flax exhaustion is a well-known phenomenon in flax-growing districts. The term, in fact, denotes damage caused by soil-inhabiting micro-organisms living on the root system and stem base of flax and which can maintain themselves in the soil for a period without the presence of a flax crop. Examples of such organisms are *Fusarium lini* (51, 75), *Phoma lini* and *Pythium megalacanthum* (103). *F. lini* is particularly common in the flax-growing districts of N. America, while *P. megalacanthum* is widespread in Belgium and the Netherlands. The only remedy for flax exhaustion is to leave a sufficient period of time between flax crops or, in other words, to grow flax only once in the rotation.

HARVESTING

Mechanical pulling is now general in all countries where flax is grown and, with the exception of Japan and to some extent N. Ireland, has completely replaced hand pulling.

HARVEST DATE

From olden times, flax for fibre production has been harvested at the early to normal yellow-ripe stage, i.e., about 3 weeks before seed maturation. Recent investigations (60) in France and Denmark indicate that harvest can be delayed until the late yellow-ripe stage with little loss of fibre yield, or about 8–10 days later than the normal yellow-ripe stage. By harvesting at the late yellow-ripe stage, maximum fibre strength and seed yields are secured, though fibre yields are probably a little lower than where the crop is harvested at the early or normal yellow-ripe stage.

The most important reason for pulling flax early is that the young, sappy stems have a greater content of water-soluble nutrients, especially N, and consequently ret more rapidly and uniformly, whether retted in water or in the field. It is probably not advisable to delay harvesting, unless it is possible to promote retting efficiency by adding nutrients, e.g. urea.

MACHINE-PULLING

Many makes of flax puller are on the market (6, 43, 46, 47), but the Belgians have led in the manufacture of large tractor-driven pulling machines and have produced the " Union Gosaert", which is currently regarded as one of the best.

Because there are technical difficulties in binding the pulled flax into sheaves by machine, large pulling machines are commonly made without binders and leave the flax in a layer on the ground. This type of harvester has resulted in the construction of special pick-up machines and swath-turners (19). These harvesting techniques are unaffected by whether the flax is to be retted by water or by dew.

HANDLING OF FLAX IN THE FIELD

Generally speaking, mechanization of the flax harvest has reduced the standard of care exercised in the pulling and subsequent treatment of the crop. The hand-pulling of former times made possible the separation of weeds from the crop, the raising of crooked or lodged stems, and piecemeal harvesting according to the degree of maturity of the crop. Hand-pulling is, of course, no longer economic in countries with high wage levels and high standards of living. Together with the disappearance of hand-pulling, many other provisions of various kinds for securing the best possible field drying, protection of the fibre from heavy rain and strong sunshine, etc., have also gone. The Dutch and Flemish stacking methods are seldom used and fibre flax is now commonly dried out as sheaves, in the same way as cereals.

SUMMARY

Much progress has been made during the last 30 years in the spheres of research and technical development in flax growing. This progress has made it possible to produce fibre flax more cheaply, though often at the expense of quality in the raw

material. It is probably correct to say that the production of flax fibre today is fully competitive with cotton production. As the major problems of flax cultivation appear to be already solved it is unlikely that, in the "free world", the next generation will be able to show corresponding progress in this direction, and without in any way wishing for, or expecting, a diminution in the scale of research on the husbandry of flax, it is not unreasonable to suppose that future developments will, and indeed must, be confined to an increasing extent to the processing of the crop, or, in other words, with the treatment of the fibre and its transformation into textile material.

BIBLIOGRAPHY

1. Aukema, J. J. 1958. [Injury to fibre flax caused by Cl IPC.] *Meded. 18 Proefsta. Akker- en Weidebouw, Wageningen* pp. 48.
2. ———— 1959. [The effect of different forms of potash and nitrogen fertilizer on fibre flax.] *Meded. 20 Proefsta. Akker- en Weidebouw, Wageningen* pp. 15.
3. Bagge, H. 1949. [Cultivation trials with fibre flax.] *Tidsskr. Planteavl* **53**, 85–130.
4. ———— and Larsen, A. 1953. [Sowing-rate trials with fibre flax.] *Tidsskr. Planteavl* **56**, 545–80.
5. ———— ———— 1958. [Varietal trials with fibre flax.] *Tidsskr. Planteavl* **62**, 47–70.
6. Bakuniak, E. 1954. Selection of an adequate machine type for harvesting of flax. [Polish] *Prace Inst. Przem. Włók. Lyk.* **2**, 22–9.
7. Barrons, K. C., Thiegs, B. J. and Watson, A. J. 1952. Tolerance of flax to sodium TCA. *Down to Earth* **7**, 11–12.
8. Black, M. A. 1946. Effect of Ceresan on the germination of stored linen-flax-seed. *N.Z. J. Sci. Tech.* **28**, 217–8.
9. Blackmann, G. E., Holly, K. and Cox, E. G. 1951. Studies in selective weed control. 4. The control of weeds in fibre flax. *J. agric. Sci.* **41**, 322–37.
10. Colhoun, J. 1957. Effects of nutrient treatments on stem-break of flax (caused by *Polyspora lini* Laff.). *Ann. appl. Biol.* **45**, 268–75.
11. ———— and Muskett, E. 1943. "Pasmo" disease of flax. *Nature* **151**, 223–4.
12. Crozier, M. N. 1950. Microscopic examination of the sectioned stem of linen flax. *N.Z. J. Sci. Tech.* **31**, 17–30.
13. Cruickshank, I. A. M. 1950–1 and 1953. Resistance of linseed and linen-flax varieties to flax-rust (*Melampsora lini*) in New Zealand. *N.Z. J. Sci. Tech. A*, **31**, 64–7 ; **33**, 62–4 ; **34**, 468–70.
14. ———— 1952. Studies on the physiologic specialization of *Melampsora lini* (Ehrenb.) Lev. in New Zealand. *N.Z. J. Sci. Tech. B*, **34**, 128–33.
15. ———— 1954. Thermochemical seed treatment. *Nature* **173**, 217–20.
16. Culbertson, J. O. and Kommedahl, T. 1956. The effect of seed coat color upon agronomic and chemical characters and seed injury in flax. *Agron. J.* **48**, 25–8.
17. Danell, N. 1956. [Varietal trials with fibre flax, 1951–5.] *Medd. 69 Stat. JordbrFörsök, Stockholm* pp. 30.
18. de Haan, H. 1953. Flax breeding and flax varieties in the Netherlands. *Euphytica* **1**, 212–8.
19. Dehondt, G. and Dehondt, R. 1956. [Machine for swath-turning flax and other crops.] *Brevet d'invention, France*, Gr. 1–Cl. 1, 1. 114. 201. Paris.
20. Dorst, J. C. 1953. Does the present trend to select for resistance to lodging in flax involve dangers of a loss in quality ? *Euphytica* **2**, 96–100.
21. Flor, H. H. 1954. Identification of races of flax rust by lines with single rust-conditioning genes. *Bull. 1087 U.S. Dep. Agric.* pp. 25.
22. ———— 1956. Mutations in flax rust induced by ultraviolet radiation. *Science* **124**, 888–9.
23. Franssen, C. J. H. 1955. [The importance of early thrips (*Thrips angusticeps* Uzel) for flax and its control in this crop.] *Tidschr. Plantenz.* **61**, 191–201.
24. ———— 1955. [The life history and control of early thrips (*Thrips angusticeps* Uzel).] *Tidschr. Plantenz.* **61**, 97–102.
25. Frederiksen, P. S. 1948. Germination of fibre flax seed injured by threshing. *C.R. Assoc. internat. d'Essais de Semences* **14**, 144–69.
26. ———— 1949. [Investigations of fibre branching in fibre flax stems.] *Lin* **5**, 101–13.
27. ———— 1950. [Investigations on fibre distribution in fibre flax stems.] *Lin* **4**, 37–45.
28. ———— 1952. *Alternaria linicola* Groves & Skolko. *Lin* **3**, 21–8.
29. ———— 1953. [Effect of Cl-containing potassium fertilizers on fibre flax.] *Tiddskr. Planteavl* **56**, 286–303.
30. ———— 1954. [Phosphorus and potassium fertilizers for fibre flax.] *Tidsskr. Planteavl* **58**, 278–97.
31. ———— 1955. [Dormancy in the fibre flax seed.] *Lin* **9**, 85–7.
32. ———— 1956. The oil content of fibre flax seed and the iodine number of the oil in relation to variety and growing conditions. *Flax, Tech. Bull.* **1**, 67–76.
33. ———— 1956. [Chemical weed control in fibre flax.] *Tidsskr. Planteavl.* **60**, 167–84.
34. ———— 1957. [Investigations of the growth of young fibre flax plants.] *Lin* **11**, 33–45.
35. ———— 1958. [Nitrogenous fertilizers for fibre flax.] *Lin* **12**, 1–9.
36. ———— 1958. [Potassium fertilizers for fibre flax. 2.] *Lin* **12**, 28–32.
37. Friederich, J. C. and Karr, Chr. C. 1955. [Report of the results of varietal trials with fibre flax during the years 1950–5.] *Meded. 32 Ned. Vlasinst. Wageningen* pp. 105.
38. Fröier, K. 1949. [Measures for producing first-class, varietally pure seed.] *Lin* **2**, 29–35.
39. ———— and Zienkiewicz, H. 1952. [The results of long-term trials on weed control in fibre flax carried out at the Flax Laboratory, Svalöf and at the Flax Processing Factory, Laholm.] *Lin* **4**, 33–43.
40. Galun, E. 1955. The effect of mechanical injury, seed treatment, soil types and soil micro-organisms on the germination of flax seed in Israel. *C.R. Ass. internat. d'Essais de Semences* **20**, 46–56.
41. Giddings, N. J. 1948. Some studies of curly top of flax. *Phytopath.* **38**, 999–1002.
42. Gilling, D. R. and Samuels, D. E. J. 1953. The structure of flax fibre strands. *J. tex. Inst.* **44**, T609–28.

43. GLERUM, J. C. 1952. [Flax-pulling machines.] *Publ. 19 Inst. LandbTech. en Rationalisatie, Wageningen* pp. 28.
44. HADFIELD, J. W. 1947. Effect of sowing method on yield of linen flax. *N.Z. J. Agric.* **75**, 177.
45. HAHN, H. 1952. [The reaction of resistant and susceptible varieties to *Colletotrichum lini* Manns et Bolley.] *Phytopath. Zeitschr.* **20**, 83–8.
46. HARMOND, J. and KLEIN, L. M. 1955. Pulling machines for harvesting fibre flax. *Circ. 955 U.S. Dep. Agric.* pp. 13.
47. HARBORD, W. L. 1943. Linen flax, improvements to pulling machines. *N.Z. J. Agric.* **67**, 161–4.
48. HAYWARD, H. E. and SPURR, Winifred B. 1944. The tolerance of flax to saline conditions : Effect of sodium chloride, calcium chloride and sodium sulfate. *J. Amer. Soc. Agron.* **36**, 287–300.
49. HOFFMAN, G. M. 1954. [Observations on browning and stem break in flax.] *NachrBl. dtsch. PflSchDienst.* **8**, 41–5.
50. HOFFMAN, W. and ZOSCHKE, U. 1955. [X-ray mutations in flax (*Linum usitatissimum* L.).] *Züchter* **25**, 199–206.
51. HOUSTON, B. R. and KNOWLES, P. F. 1953. Studies on Fusarium wilt of flax. *Phytopath.* **43**, 491–5.
52. HUTCHINSON, R. J. 1950. Fibre division progress report 1937–1947. Pp. 47, Canada Dep. Agric. Cent. Exp. Fm.
53. s'JACOB, J. C. 1955. Research on the susceptibility of flax to flax rust (*Melampsora lini*). *Euphytica* **4**, 107–15.
54. JENSEN, W. 1951. Effect of boron on germination of flax seed and on respiration of flax seedlings. *Bot. Gaz.* **103**, 180–5.
55. KOLK, H. 1954. [Present-day fungus diseases of flax seed and the importance of the advisory leaflet in their control.] *Medd. Frökontrollanst. Stockh.* **29**, 47–61.
56. KOMMEDAHL, T., CHRISTENSEN, J. J., CULBERTSON, J. O. and MOORE, M. B. 1955. The prevalence and importance of damaged seed in flax. *Bull. 215 Tech. Univ. Minn. Agric. Exp. Sta.* pp. 38.
57. KOOPMAN, J. F. and DE TEMPE, J. 1954. Comparison of laboratory evaluation and field performance of flax seed. *C.R. Ass. internat. d'Essais de Semences* **19**, 24–31.
58. LARSEN, A. 1952. [Trials with different preceding crops for fibre flax.] *Tidsskr. Planteavl* **55**, 557–77.
59. ———— 1956. Some results of recently completed Danish experiments with row-distance and seed-rate in fibre flax. *Flax, Tech. Bull.* **2**, 41–51.
60. ———— 1958. [Harvest-date trials with fibre flax for retting.] *Tidsskr. Planteavl* **62**, 259–79.
61. LACHANCE, R. O. 1951. [Antagonism of soil micro-organisms against *Colletotrichum linicola*, the cause of flax anthracnose.] *Can. J. Bot.* **29**, 438–49.
62. LACROIX, L. 1952. [Trials with fibre flax.] *Rev. Agric.* **5**, 1219–29.
63. LEHR, J. J. and WYBENGA, J. M. 1955. Exploratory pot experiments on sensitiveness of different crops to sodium. C. Flax. *Plant and Soil* **6**, 251–61.
64. LEWIS, A. H. 1943. The uptake of nutrient by flax. *J. agric. Sci.* **33**, 169–73.
65. LONERAGAN, J. F. 1951. The effect of applied phosphate on the uptake of zinc by flax. *Aust. J. sci. Res. B*, **4**, 108–14.
66. LORENT, J. 1955. [The behaviour of flax varieties in 1954 at the Research Station, Gembloux.] *Rev. Agric.* **8**, 1034–7.
67. MCKAY, R. 1947. Flax diseases. Pp. 55, Dublin.
68. MILLIKAN, C. R. 1949. Lower leaf scorch of flax. *J. Dep. Agric. Vict.* **47**, 37–41.
69. ———— 1950. Relation between nitrogen source and the effect on flax of an excess of manganese or molybdenum in the nutrient solution. *Aust. J. sci. Res.* **3**, 450–73.
70. MILTHORPE, F. L. 1945. Fibre development of flax in relation to water supply and light intensity. *Ann. Bot., N.S.* **9**, 31–53.
71. ———— 1946. Studies on the mineral nutrition of flax. *Publ. 1 Bot. Sch. Univ. Sydney* pp. 66.
72. MINISTRY OF AGRICULTURE, NORTHERN IRELAND. 1954. Results of flax variety trials. *Mon. Agric. Rep.* **29**, 67–70 and 106–7.
73. MISRA, A. P. 1952. Factors affecting variability in the development of *Melampsora lini*. *Phytopath.* **42**, 204–11.
74. MUSKETT, A. E. and COLHOUN, J. 1947. Diseases of flax. Pp. 112, Belfast.
75. NEWHOOK, F. J. 1947. The detection of browning (*Polyspora lini*) and wilt (*Fusarium lini*) in seedlines of linen flax. *N.Z. J. Sci. Tech. A*, **29**, 44–8.
76. NIKL–NAVRATIL, H. 1951. [Observations and investigations on the cause of flax browning (*Polyspora lini* Lafferty).] *Faserforsch. u. Textiltek.* **2**, 453–5.
77. NILSON, P. E. and BINGEFORS, S. 1951. A method for routine testing of seed treatments in laboratory. *K. LantbrHögsk. Ann.* **18**, 106–12.
78. OPITZ, K. and MAUERMANN, G. 1942. [Investigations of the effect of drought on flax and spring barley.] *Landwirtsch. Jahrb.* **91**, 576–616.
79. PAINTER, E. P., NESBITT, L. L. and STOA, T. E. 1944. The influence of seasonal conditions on oil formation and changes in the iodine number during growth of flax seed. *J. Amer. Soc. Agron.* **36**, 204–13.
80. PAWLOWSKA, J. 1955. Investigation of flax pectin. [Polish] *Prace Inst. Przem. Wlók. Lyk.* **3**, 23–32.
81. PETERSEN, E. J. and PETERSEN, H. I. 1957. [Trials on the chemical control of weeds in fibre flax and oil-seed flax.] *Tidsskr. Planteavl* **61**, 408–44.
82. PLONKA, F. 1951. [Genetic behaviour of some characteristics of the flowers and seed of flax.] *Ann. Inst. nat. Rech. Agron.* **1**, 155–78.
83. ———— 1956. [Flax varieties and their principal cryptogamous diseases.] Pp. 179, Paris.
84. ———— 1957. [The geographical groups of flax.] *Ann. Inst. nat. Rech. Agron. B*, **7**, 109–38.
85. POLLET, H. 1956. [The diseases of flax.] *Flax, Tech. Bull.* **1**, 99–108.
86. PONTOPPIDAN, H. 1957. [The dependence of the yield of fibre flax on the rainfall in early summer.] *Lin* **5**, 53–7.
87. ———— 1958. [Irrigation of fibre flax.] *Lin* **3**, 21–7.
88. PUGSLEY, A. P. and HOCKLEY, S. R. 1947. Flax varieties and flax breeding at the Waite Institute, 1943–1946. *J. Dep. Agric. S. Aust.* **51**, 65–70.
89. RATAJ, K. 1956. [Use of 2-methyl, 4-chlorophenoxyacetic acid for weed control in fibre flax.] [Czechoslovakian] *Socialist. LandWiss. A*, **5**, 339–84, German and English summaries.
90. REITZ, L. P., HANSING, E. D., DAVIDSON, F. E. and DECKER, A. E. 1947. Viability and seed treatment of flax. *J. Amer. Soc. Agron.* **39**, 959–70.
91. ROELOFSEN, P. A. 1951. Contradictory data on spiral structures in the secondary cell wall of fibres of flax, hemp and ramie. *Tex. Res. J.* **21**, 412–18.
92. RÜDIGER, W. 1952. [On the pathological anatomy of flax (*Linum usitatissimum*).] *Phytopath. Zeitsch.* **19**, 34–47.

93. Sackston, W. E. 1950. Effect of Pasmo disease on seed yield and thousand kernel weight of flax. *Can. J. Res.* **28**, 493–512.
94. Schober, E. J. and Menzel, K. C. 1955 and 1956. [The effect of moisture conditions on the flax plant.] *Faserforsch. u. Textiltech.* **6**, 479–89 and 539–45.
95. Schwinghamer, E. A. 1956. Physiologic specialization in *Colletotrichum linicolum*. *Phytopath.* **46**, 300–5.
96. Searle, G. O. 1956. Flax breeding for yield and quality of fibre flax. *Flax, Tech. Bull.* **1**, 6–18.
97. Sieben, J. W. 1953. The correlation between resistance to lodging and fibre content in flax. *Euphytica* **2**, 101–6.
98. Skarzynski, J. 1956. The yield and density of fibre flax with regard to the sowing time. [Polish] *Prace Inst. Przem. Wlók Lyk.* **4**, 1–7.
99. Smith, W. P. C. 1948. Zinc deficiency of flax. *J. Agric. W. Aust.* **25**, 136–42.
100. Spek, J. van der. 1957. [The influence of external environment on the effectiveness of the treatment of flax seed.] *Meded. LandbHogesch. OpzoekSta., Gent* **22**, 535–45.
101. Veenenbos, J. A. J. 1957. [Control of flax flea-beetle by seed disinfection with lindane.] *Flax, Tech. Bull.* **2**, 33–7.
102. Wallen, V. R. and Skolko, A. J. 1951. A comparison of seed testing methods in relation to the stem-break and browning disease in flax caused by *Polyspora lini* Laff. *Can. J. Bot.* **29**, 138–42.
103. Wiersema, H. T. 1955. Flax scorch. *Euphytica* **4**, 197–205.
104. Wright, G. M. 1951. A statistical study of linen flax crops records. *Bull. 104 N.Z. Dep. Sci. Industr. Res.* Pp. 40.
105. Zwijns, M. J. and Feekes, F. H. 1953. [Tests of seed disinfection with tetramethyl thiuram disulphide (TMTD or thiram) and quinones.] *Meded. LandbHogesch. OpzoekSta., Gent* **18**, 492–512.

(Original, in Danish, received for publication 27 July, 1959)

FIELD CROPS

CEREALS

WHEAT

See also Abs. 1789, 1790, 1791, 1792, 1798, 1799, 1885, 1947, 1968, 2013, 2043, 2048, 2057.

1646 Giannesini, J.-P. Le blé dur, culture méridionale nouvelle. [**Durum wheat, a new crop in south France.**] *Bull. tech. Inform.* 1959, No. 136, 17–23, illus.

Durum wheat [*Triticum durum*], which was rarely cultivated in France a few years ago, is now grown on more than 25,000 ha. in the southern regions. There are prospects for the further expansion of this crop because of the great demand for its grain. The cultural requirements of durum wheat are described. Although it is a crop for semi-arid regions, its water requirements are high during the critical phases of development (tillering, shooting, earing). On good soils yields are up to 4000 kg./ha. and average 3000–3500 kg./ha., but on most soils they average 1800–2500 kg./ha. Trials are in progress at the Station d'Amélioration des Plantes at Montpellier to study varieties and growing methods. Tabulated results, including yields, are given from trials with the varieties Bidi 17 and Oued-Zénati 368.—E.B.O.

1647 Army, T. J. and Hide, J. C. **Effects of green manure crops on dryland wheat production in the Great Plains area of Montana.** *Agron. J.* 1959, **51,** No. 4, 196–8, bibl. 13. [Montana Agric. Exp. Sta., Bozeman]

Spring or winter wheat was grown in a 4-yr. rotation with maize, oats, and fallow at 3 locations with 11·5 – 15 in. rainfall/yr. for 28, 39 or 43 yr., with or without peas, sweet clover or rye as green manure during part of the fallow period. Green manuring did not increase wheat yields, bushel weight or grain protein content. It was concluded that in areas receiving less than 18–20 in. rainfall/yr., green manuring would not be beneficial.—R.B.

1648 Reiss, B. C. R. **Winter wheat variety trials 1952-56.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 271–84, bibl. 9.

In trials at 17 centres in England and 1 in Scotland, 28 varieties of winter wheat were compared with Bersee, Hybrid 46 and Holdfast. Thirteen of the varieties completed an extensive series of trials and the results for these varieties are given in detail. Yield, straw and field characters, maturity and disease resistance of the varieties tested are noted. Heines VII approached Hybrid 46 in yield, but showed no advantages in disease resistance or grain quality. Of the varieties with good bread-making and milling quality, Dominator and Milfast gave yields comparable with Bersee. Relative to Bersee, N.59 showed a significant regional preference for the Cumberland and Edinburgh centres. F. s.—A.M.H.

1649 Rivett, A. D. **Winter wheat variety trials, 1954-57.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 285–93, bibl. 6.

The results are reported of 42 trials of the winter wheat varieties Leda, Mado, Panter, Tavero, Vilmorin 53 and Bersee, compared with Hybrid 46. Details of yields, winterhardiness, disease resistance, maturity, length and strength of straw, and grain quality are given. None of the varieties was superior to Hybrid 46. F. s.—A.M.H.

1650 Evans, A. W. **Spring wheat variety trials, 1950-57.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 257–70, bibl. 5.

In trials at 16 centres in England, 2 in Wales and 1 in Scotland, 14 spring wheat varieties were compared with Atle. The field characters, quality and disease susceptibility of the varieties tested are noted. Four varieties yielded significantly more than Atle. In order of yield these were : Koga II, Teutonen, Svenno and Koga.—A.M.H.

1651 Carson, G. P. **Descriptions of wheat and oat varieties.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 294–6, bibl. 6, illus.

The botanical characters of the newly recommended varieties Milfast winter wheat and Penrhyn winter oats are described. F. s.—A.M.H.

1652 Inkilä, O. and Pesola, V. A. Norrönakevätvehnä. [**Norrøna, a summer wheat.**] *Maatal. ja Koetoim.* 1959, **13,** 76–81, illus., German summary. [Agric. Res. Centre, Jokioinen, Finland]

This Norwegian variety ripens in Finland an average of 4 days earlier, and yields 14% more grain than the Swedish wheat Diamant. Norrøna cannot be recommended, however, for intensive cultivation in Finland because of its weak straw. F. Ger. s.—M.H.

1653 López-Ríoboo, T. F. and Prieto, H. E. Ensayos comparativos de variedades de trigos. [**Comparative trials with wheat varieties.**] *An. Inst. nac. Invest. agron.* 1958, **7,** No. 4, 711–875, illus.

The results are given from trials throughout Spain, in 1954–5, to test wheat varieties. Application has been made to include several of them in the official list of commercial varieties.—E.B.O.

1654 Llovet, M. J. Comentario a la pasada campaña triguera. [**Remarks on the past wheat season.**] *Bol. agro-pec.* 1958, July-Sept., 82–7, illus.

In plot trials with wheat varieties at Torrebonica, Barcelona province, satisfactory yields were obtained from early varieties only, which are in full flower on about 20 Apr. and thus benefit from the April rains ; the best of them was Montserrat (Montjuich × Damiano Chiesa) with 2660 kg./ha. —E.B.O.

1655 Giornale di Agricoltura della Domenica. " Carlo Gallini " un nuovo frumento. [**Carlo Gallini, a new wheat variety.**] *G. Agric. Domen.* 1959, **69**, No. 25, 245.

A description is given of the new autumn-sown variety of soft wheat, C. Gallini, which is early, resistant to cold, disease and lodging, and is suitable for cultivation in the plains of Italy. It should be sown at 140–150 kg./ha. Yields of C. Gallini are similar to those of S. Pastore, from which it is derived.—E.B.O.

1656 Baldoni, R. and Toderi, G. Varietà di grano duro più diffuse in coltura. [**Durum wheat varieties most widely grown (in Italy).**] *Quad. 8 Ente naz. Sementi elette* 1959, pp. 16, bibl. 11, illus. [Milano, Italy]

The characteristics are given of the selected durum wheat varieties : Aziziah 301, Cappelli, Dauno III, Garigliano, Russello S.G.7., Timilia S.G.1, Tripolino, Grifoni 235 (B 52), Capeiti 8, Duro S.G.3 and Patrizio 6.—E.B.O.

1657 Nikolic-Vig, V. Coltivazione nella Vojvodina delle razze di grano italiane. [**Cultivation of Italian wheat varieties in the Vojvodina region (Yugoslavia).**] *Progresso agric.* 1959, **5**, No. 2, 198–207, illus. [Ist. Agr. Sper., Novi Sad, Yugoslavia]

Vojvodina, the most progressive agricultural region of Yugoslavia, has a continental climate with very cold winters and hot, dry summers. The results are given from trials with Italian wheat varieties in 1956–8. Some of these varieties showed good adaptation to the Vojvodina, being high-yielding and resistant to cold, lodging and rust. [See also Abs. 1104.]—E.B.O.

1658 Sikka, S. M. and Jain, K. B. L. **A study of the differential responses of some varieties of wheat to different environmental and cultural conditions. 1. Performance under rainfed conditions.** *Indian J. Agron.* 1958, **3**, No. 2, 71–81, bibl. 1. [Indian Agric. Res. Inst., New Delhi]

The performance of 51 varieties of *Triticum aestivum* comprising exotics, New Pusa and other Indian wheats was studied under rainfed conditions at Delhi for 3 years. On the basis of combined analysis of results for these years, N. P. 823, N. P. 824, and N. P. 828 were adjudged to have better adaptability to rainfed conditions than other wheats. These wheats also revealed a high degree of plasticity, on which account they can adjust themselves admirably to seasonal fluctuations and so give high grain yields. The plasticity of these varieties could, perhaps, be correlated with their wide genetic diversity. F. S.—D.B.

1659 Warmbrunn, K. Prüfung des deutschen Weizensortiments auf Widerstandsfähigkeit gegen Zwergsteinbrand (*Tilletia controversa* Kühn). [**Testing German wheat varieties for resistance to dwarf bunt (*T. controversa* Kühn).**] *Angew. Bot.* 1959, **33**, No. 1, 1–8, bibl. 2. [Pflanzenschutzamt, Stuttgart, W. Germany]

The entire range of German wheat varieties was tested over 3 years for resistance to dwarf bunt in areas of the Schwäbische Alb where wheat is known to be subject to attack by this fungus. No variety proved to be completely resistant. Relatively resistant varieties were Graf Toerring II, Erbachshofer Braun, HS Burgweizen and Wahrberger Ruf. These were followed (in resistance) by Heges Früher and Karat.—D.B.

1660 Glynne, Mary D. and others. **Fungi and fungus diseases. [Eyespot (*Cercosporella herpotrichoides*) and take-all (*Ophiobolus graminis*).]** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 107–10.

When sown at 3 bu./ac., the first wheat crop after fallow had only a trace of take-all and the 2nd was very severely stunted, but when sown at 0·3 bu./ac. the 2nd wheat crop was lightly and the 3rd severely infected. Eyespot was severe after a 1-yr. fallow in wheat sown at 3 bu./ac., but only moderate in that sown at 0·3 bu./ac. In a small-plot experiment to measure the effect of sowing date, seed rate and N [see *Fld Crop Abstr.* 11 : 1544], Cappelle wheat was grown on rich land free from appreciable eyespot and take-all. Yields were 51, 48, 37 and 36 cwt./ac. for plots sown on 26 Sept., 11 Oct., 8 Nov., and 6 Dec., respectively. The higher seed rates and higher levels of N increased lodging and therefore decreased yields. Mean yields of plots sown at 1·5, 3·0 and 4·5 bu./ac. were 43, 44 and 34 cwt./ac., respectively. Plots sown at 4·5 bu./ac. and receiving 0, 3, 6 and 9 cwt. ammonium sulphate/ac. yielded, respectively, 42, 40, 32 and 21 cwt./ac., with 0, 5, 20 and 62% of their areas lodged. N had little effect on yields of the plots sown at 1·5 and 3·0 bu./ac.—A.M.H.

1661 Bardner, R. **Wheat-bulb-fly (*Leptohylemyia coarctata* Fall.) control.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 126–7.

The effect of seed dressings applied at 2 to 12

times the conventional rate was tested in field experiments. The insecticides used were aldrin, dieldrin and heptachlor in an aqueous solution of methyl cellulose as a sticker. The treatments increased yield from 11·5 cwt./ac. to 25·2–27·6 cwt./ac. Heptachlor was slightly better than aldrin and dieldrin. Insecticide dressings of 1% of the weight of seed were only slightly better than 0·15% dressings. The seed treatments were superior to combine-drilled aldrin and dieldrin at 1·5 lb./ac., which gave yields of 19·7 and 17·0 cwt./ac., respectively.—A.M.H.

1662 Valdeyron, G. and Seguela, J.-M. Étude bibliographique et expérimentale sur le mitadinage. [**Bibliographical and experimental study on yellow-berry.**] *Ann. Amélior. Pl., Paris* 1958, **8**, No. 3, 291–328, bibl. 31, illus., English, German and Russian summaries. [Inst. Nat. Agron., Paris, and Serv. Bot. Agron., Tunisia]

The results are given from trials with durum wheat varieties in 1956–7 [see *Fld Crop Abstr.* 11 : 470]. The varieties tested showed different susceptibility to yellow-berry.—E.B.O.

1663 Miyamoto, T. and Everson, E. H. **Biochemical and physiological studies of wheat seed pigmentation.** *Agron. J.* 1958, **50**, No. 12, 733–4, bibl. 10. [Michigan State Univ.]

1664 Hewett, P. D. **Effects of heat and loss of moisture on the dormancy of wheat, and some interactions with 'mergamma D'.** *Nature, Lond.* 1959, **183**, No. 4675, 1600, bibl. 2. [Licensed Seed Test Sta., Christopher Hill Ltd., Poole, Dorset]

The author's tests with wheat varieties show that dormancy in this crop is not overcome by oven treatment, as in the case of barley [see *Fld Crop Abstr.* 11 : 962], and that the mercury/BHC seed dressing is partly responsible for enhancing dormancy in wheat.—M.H.

1665 Tung-Fang, C. **Dormancy of wheat grains harvested at different stages of maturity and treated with various methods.** [Chinese] *Acta bot. sinica* 1957, **6**, No. 1, 80–90, bibl. 20, English summary. [Inst. Pl. Physiol., Academia Sinica] [Received July, 1959]

Red varieties of wheat had a longer period of dormancy than had white varieties. Grain harvested at the milk-ripe stage germinated only after 2 months' storage. Drying at room temperature to 10% moisture content, in the presence of $CaCl_2$, increased percentage germination of grain harvested later than the milk-ripe stage. The dormant period of grain dried at 25–30°C. was shorter than in grain dried at 4–8°C. In white varieties there was no correlation between length of dormancy and vernalization characteristics, but in red varieties, those with the longer dormant period were of the semi-winter type. Fumigation with chloropicrin (80 g./c.m.) reduced viability in white, but not in red, varieties. The embryo of dormant grain germinated immediately if separated from the endosperm. The physiology of dormancy in the wheat grain and sprouting in the ear before harvest are discussed in the light of the results of these experiments and of earlier literature. F. Eng. 8.—D.B.

1666 Riddell, J. A. and Gries, G. A. **Development of spring wheat : 3. Temperature of maturation and age of seeds as factors influencing their response to vernalization.** *Agron. J.* 1958, **50**, No. 12, 743–6, bibl. 12. [Purdue Univ., Lafayette, Indiana]

Seed of the spring wheat varieties Chinese, Warden, Progress and White Federation 38, harvested in different years, was placed in the dark at 70°F. for 48 hr. after sowing, and transferred to 34°F. for 0, 10, 30 and 60 days. Sowing time was arranged so that all vernalization treatments were completed at the same time. Plants were grown at 60–80°F., under 16-hr. photoperiods. In all varieties except Progress, the time from the end of vernalization treatment to floral initiation and to flowering and the number of nodes present at flowering, decreased as the vernalization period increased. Growth following floral initiation was influenced by vernalization in Progress, only. The rate of development and the number of nodes at flowering in the late varieties Chinese and Warden after 60 days' vernalization was similar to that of the early varieties. The interval between sowing and flowering, including vernalization time, was slightly reduced in Chinese and Warden by 10 days of vernalization ; in all other varieties, vernalization lengthened this period. Plants grown from seed of different ages matured at different rates when unvernalized ; the amount of variation was much less after vernalization. In the winter wheat variety Knox, vernalization for longer than 20 days caused a rapid decrease in the time required for floral initiation and for flowering, and in the number of nodes present at flowering. The interval between floral initiation and flowering was greatest after 30 days' vernalization. Plants grown from seed matured at 60°F. developed more quickly than those grown from seed matured at 80°F. or at glasshouse temperature (65–80°F.), except when vernalized for 60 days.—R.B.

1667 Cheng, T. and Pao-Kuei, W. **The effect of micro-elements on the vernalization of wheat.** [Chinese] *Acta bot. sinica* 1957, **6**, No. 4, 289–96, bibl. 23, illus., English summary. [Peking Inst. Pl. Physiol. and Nankai Univ.] [Received July, 1959]

Wheat grains of the varieties Sui-yuan, Sino-soviet 68 and Kingling Univ. 2905 were soaked for

14 hr. in micro-element solutions (details given) then vernalized at 0–3°C. for periods from 15 to 50 days. Cu, Zn, Mo and B stimulated early growth and accelerated development, bringing forward the date of heading by several days. Mn and Fe stimulated early growth only. F. Eng. s.—D.B.

1668 Markowski, A. Wpływ swiatła na jaryzacje pszenicy ozimej. Studia nad rozwojem pszenic. Część IV. **The influence of light on the vernalization of winter wheat. (Studies on the development of wheat. Part 4).** *Roczn. Nauk rol.* 1959, **79**, Ser. A, No. 3, 689–731, bibl. 20, Russian and English summaries. [See also *Roczn. Nauk rol.* Vol. 77, Ser. A, 1957.]

1669 Rivière, J. Étude microbiologique de la rhizosphère du blé. [**Microbiological study of the wheat rhizosphere.**] *Ann. Inst. nat. agron., Paris* 1958, **44**, 75–82.

This study was carried out with the spring wheat variety Fylgia grown in pots containing clay soil.—E.B.O.

1670 Weissman, G. S. **Influence of ammonium and nitrate on the protein and free amino acids in shoots of wheat seedlings.** *Amer. J. Bot.* 1959, **46**, No. 5, 339–46, bibl. 33. [Rutgers Univ., Camden, New Jersey]

1671 Kretovič, V. L. and Poljanovskiĭ, O. L. [**The biosynthesis of tryptophane in the ear of wheat.**] [Russian] *Izv. Akad. Nauk, SSSR (Bull. Acad. Sci., USSR, Biol. Ser.)* 1959, No. 3, 428–30, bibl. 7, English summary. [Tech. Inst. Food Prod., Moscow]

1672 Downs, R. J. and others. **Effects of photoperiod and kind of supplemental light on growth and reproduction of several varieties of wheat and barley.** *Bot. Gaz.* 1959, **120**, No. 3, 170–7, bibl. 27, illus. [Crops Res. Div., USDA, Beltsville, Maryland]

Plants of the wheat varieties Reward, Thatcher, Cadet, Ramona 44, Marquis and Lee, and of the barley varieties Atsel, Trebi, Betzes, Herta, 72–E_2E_2–15 and 72–e_2e_2–15 were given photoperiods of 12 and 16 hr., consisting of nearly 12 hr. daylight supplemented by artificial light supplied by (a) fluorescent lamps, (b) frosted glass filament lamps, (c) ruby red filament lamps, or (d) dark blue filament lamps. Under 16-hr. photoperiods, inflorescences appeared earlier, stems were longer and more numerous and heavier grains were produced in both wheat and barley, and slightly fewer tillers were produced in wheat, than under 12-hr. photoperiods. Inflorescences emerged earliest under (a) lamps at 16-hr. photoperiods, and latest under (d) lamps and 12-hr. photoperiods. The length of stems, and the number and weight of grains produced, were greatest under (b) and (c) lamps and least under (d). Reward and Ramona 44 were less influenced by photoperiod than other wheat varieties. Plants of 72-e_2e_2-15 flowered considerably later than those of 72-E_2E_2-15 under short-day, while under long-day these varieties were equally early.—R.B.

1673 Sugino, M. **Flower initiation of the spring wheat in total darkness.** *Bot. Mag., Tokyo* 1957, **70**, No. 833–4, 369–75, bibl. 14. [Fac. Agric., Kyoto Univ., Japan]

For normal development (including flowering) of wheat plants (Konosu No. 25) grown in nutrient solution under different photoperiodic conditions, no sucrose was required when plants were under continuous light, 2% was necessary under short-day (8 hr.), and >4% under total darkness. Flowering was delayed and the number of leaves prior to flowering increased as the photoperiod was reduced.—D.B.

1674 Laskin, V. P. [**Transforming spring wheat to winter wheat under conditions of the south-east (of European USSR).**] *Agrobiologija (Agrobiology, Moscow)* 1958, No. 6 (114), 54–60. [Sci. Res. Inst. Agric., Saratov]

1675 Šu-Ven', [Shuveng] Ju. and others. [**Hardening wheat (čžun-da 2419) against drought.**] [Chinese] *Acta bot. sinica* 1958, **7**, No. 4, 171–86, bibl. 32, illus., Russian summary. [Inst. Plant Physiol., Acad. Sci., China]

In China, wheat is mostly grown in the northern provinces where drought is prevalent and the drought resistance of crops is therefore of much significance. During 1954–7, in Shanghai, wheat grain was hardened by Henkel's method (3-fold pre-sowing soaking in water and subsequent drying). The treatment enhanced the rate of plant growth (especially at the seedling stage) and intensified the plants' physiological processes. The drought resistance of the plants (determined by Tumanov's method) was improved by the treatment and crop yields were increased by 8–30%. F. Russ. s.—M.H.

1676 Pohjanheimo, O. Syysvehnän talvenkestävyydestä maamme viljelyoloissa. [**The capacity of wheat to overwinter in Finnish conditions.**] *Maatal. ja Koetoim.* 1959, **13**, 98–109, illus., German summary. [Agric. Res. Centre, Jokioinen, Finland]

In S. and W. Finland, winter wheat often fails to survive the winter. Laboratory tests to determine why winter wheat grown on the light soils of the regions where there is abundant snow does not overwinter as satisfactorily as winter rye, showed

that the resistance to cold of wheat roots was much lower than the roots of Finnish varieties of rye. In addition, the roots of rye varieties had a greater capacity than wheat roots to regenerate after damage. It is maintained that the growing of rye × wheat (*Triticale*) should be extended for winter cereal production in Finland. F. Ger. s.—M.H.

1677 Heber, U. Ursachen der Frostresistenz bei Winterweizen. 1. Die Bedeutung der Zucker für die Frostresistenz. [**Causes of frost resistance in winter wheat. 1. The importance of sugar in frost resistance.**] *Planta* 1958, **52**, No. 2, 144–72, bibl. [Inst. Landw. Bot., Univ. Bonn, W. Germany]

The monosaccharide content was a better measure of frost resistance than was total sugar. Some observations are made on the role of sugars in frost resistance.—D.B.

1678 Boldyrev, N. K. **Relation between the chemical composition of leaves, yield and grain quality of spring wheat, as dependent on the fertilizers applied.** [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1959, **126**, No. 4, 886–9, bibl. 25.

The dependence of wheat grain yields on the chemical composition of the leaves is somewhat obscure and there are no data regarding the " critical level " of nutrition for spring wheat. The critical level signifies that percentage content of a given element in the leaves above which no augmentation of grain yield is produced when the element is added to the nutrient medium. The critical concentration of an element in the nutrient supply is that, between certain limits, above which the quantity of the element concerned is surplus to the plant's requirements and below which the plant is deficient in the element. During 1954–7, field and laboratory tests were made with wheat on medium sandy and argillaceous chernozems with different amounts of N and P fertilizers, to determine the movements of nutrients in the soil, to determine the level of N nutrition by leaf analysis at the end of the flowering stage, and the critical levels of N and P in wheat nutrition. The data indicate : (1) that this critical level is reached when leaf analysis shows 2·6–3%N and 0·52–0·6% P_2O_5 content (under favourable conditions this ensures a grain yield of 2500–3500 kg./ha.) ; (2) the spring-wheat crop is not in need of N if the N content in the leaves at the end of the flowering/seed-setting stage is 2·6–3%, or if the N : P_2O_5 ratio is >5 ; and (3) spring wheat does not require P if the P_2O_5 content in the leaves is 0·52–0·6%, or the N : P_2O_5 ratio is $<5·1$. The possibility of utilizing data from leaf analysis to determine the need of a crop for N and P has been confirmed in field experiments at a State farm in the Moskalensk area of the Omsk Province.—M.H.

1679 Haas, H. J. **N/P ratio of wheat grain as an indication of nitrogen fertilizer requirement.** *Agron. J.* 1959, **51**, No. 5, 309–10. [Western Soil and Water Mgmt Res. Br., Agric. Res. Serv., USDA, Mandan, N. Dakota]

The grain of wheat grown at 14 locations with various combinations of N and P fertilizer was analysed for N and P content. The relative yield of plots fertilized with N was more closely related to the N/P ratio in the grain than to the percentage N content. Where the N/P ratio was greater than 6, the increase in yield from additional N was slight; the yield response to N became greater as the N/P ratio decreased. The correlation between the grain N/P ratio and the yield response to N in the following year was –0·67.—R.B.

1680 Simkins, C. A. **Investigations of effects of soil and foliar applications of urea and ammonium nitrate on yield and quality of wheat.** *Diss. Abstr.* 1959, **19**, No. 6, 1155. [Kansas State Coll., Manhattan]

In the 4 glasshouse and 2 field trials reported, a silt loam soil on which crops responded well to N treatments was used. In the glasshouse trials, foliar N treatments increased grain yields of wheat where the equivalent of 100 lb./ac., or more, was used, but yields were lower than where the same amount of N was applied to the soil. N applied at sowing produced the highest grain yields. Urea and ammonium nitrate were equal in their effect on yields. In field trials in 1951, foliar applications of urea, and in particular, ammonium nitrate, significantly reduced grain yields when applied just before flowering, or at later growth stages. In field trials in 1952, foliar treatments significantly increased grain yields. Soil applications of N resulted in significantly higher yields than foliar applications when applied before flowering ; the opposite effect resulted from treatments made after flowering. In general, ammonium nitrate resulted in higher yields than urea when applied before flowering ; urea was superior to ammonium nitrate when applied after flowering.—P.J.B.

1681 Coïc, Y. Recherches sur le meilleur équilibre " densité de semis, fertilisation azotée" du blé d'hiver. [**Investigations on the best equilibrium " seed rate, N manuring " for winter wheat.**] *C.R. Acad. Agric. Fr.* 1958, **44**, No. 15, 761–5, bibl. 2.

In a plot trial on clay soil high in assimilable phosphoric acid and potash, Cappelle wheat was sown at 50, 75, 100 or 125 kg./ha., with 6 types of N manuring. The highest yield of grain, 6100 kg./ha. was obtained from sowing at 125 kg./ha. and the following N dressings : 40 kg. at tillering and 60 at beginning of shooting, or 70 at tillering and 30 at shooting. The next best yield, 6000 kg. grain/ha., was obtained from sowing at 100 kg./ha.

and dressing with 40 kg. N at tillering and 60 at shooting. It is thought that under the conditions of this trial, the optimal N manuring could possibly have been : 60 kg. at tillering, 40 kg. at beginning of shooting and 20 kg. at earing.—E.B.O.

1682 Eck, H. V. and Stewart, B. A. **Response of winter wheat to phosphate as affected by soil and climatic factors.** *Agron. J.* 1959, **51**, No. 4, 193–5, bibl. 8. [Oklahoma Agric. Exp. Sta., Stillwater]

Results of 53 field trials with winter wheat grown on 36 soils containing 16–59 lb. available P/ac. and fertilized with 40 lb. N/ac., with or without 20 lb. P_2O_5/ac., indicated that yield level, date of sowing, soil moisture content during sowing, level of soil P and the number of degree-days above 90°F. during the last 20 days before harvest, were all significantly related to the yield response to fertilizer P. Temperature showed the closest correlation with yield response. F. s.—R.B.

1683 Peken'o, P. H. [**The effect of fertilizers on anatomy of the stem and resistance to lodging of winter wheat plants.**] [Russian] *Izv. Timirjazevsk. S.-H. Akad. (Bull. Timirjazev agric. Acad.)* 1959, No. 2 (27), 209–16, bibl. 15, illus., English summary.

A fertilizer study was designed in East Kazahstan to determine the effect of nutrient supply on the structure of the mechanical tissue in spring wheat. In E. Kazahstan the average annual precipitation is 700 mm., of which nearly half falls in June and July. In 1956 during the vegetative period (May-August) there were 386 mm. A snow cover of 80–100 cm. or more prevails from the first half of November to early April ; thaw waters maintain a high soil-moisture content (32–34% of soil weight). The experiments were on medium argillaceous soil of the mountain meadows and determination was made of the characteristics of the stems under varying P and K fertilizers. It is concluded that the main indicator of good resistance to lodging in spring wheat is rapid stem formation and early lignification of the lower internodes at the beginning of milk-ripeness. Under conditions in E. Kazahstan, 300 kg. granulated superphosphate per ha. in early spring, before tillage, is recommended to obviate lodging. In soils with a high content of assimilable K, potassic fertilizer is conducive to lodging in spring wheat.—M.H.

1684 Franc de Ferrière, P. J. J. and others. Influence des types d'argile des sols et de la pluviosité sur la nutrition potassique du blé. [**Influence of type of soil-clay and rainfall on the K nutrition of wheat.**] *Ann. agron., Paris* 1958, **9**, No. 2, 149–66, English, German and Russian summaries. [Soc. Comm. Potasses d'Alsace, Mulhouse, France]

The effect on wheat yields of different types of clay in relation to rainfall during Nov.-Apr. was investigated in 8 K-manurial field trials. Results indicated that : (a) the depressing effect of increasing rainfall on wheat yields varied with type of clay ; an increase in the N and humus content of the soil partially counteracted this depressing effect ; (b) the effectiveness of K fertilizers on wheat yield varied with type of clay. [See also *Fld Crop Abstr.* 12 : 575.]—E.B.O.

1685 Foti, S. Lavori profondi e concimi minerali in ambiente caldo-arido. [**Deep cultivation and mineral fertilizers in a warm-arid environment.**] *Ital. agric.* 1958, **95**, No. 12, 885–90, bibl. 4. [Ist. Agron., Univ. Catania, Sicily]

In a plot trial in Sicily on clay soil in 1955, the effect on wheat yield of the following treatments was tested : cultivation to a depth of 20 or 40 cm.; manuring with (a) calcium nitrate 120 kg./ha., top-dressed ; (b) superphosphate (18–20%) 600 kg., sulphate of ammonia (20–21%) 200 kg. and potassium sulphate (48–50%) 200 kg. per ha., applied before sowing ; (c) treatments a and b combined. The durum wheat varieties Cappelli, Garigliano and Russello were used. Results (tabulated) showed a considerable advantage from cultivating to a depth of 40 cm., and from the manurial treatments b and c.—E.B.O.

BUCKWHEAT

See also Abs. 1968.

1686 Iwaki, H. **The influence of density on the dry-matter production of *Fagopyrum esculentum*.** *Jap. J. Bot.* 1958, **16**, No. 2, 210–26, bibl. 15. [Univ. Tokyo]

The plant spacings tested were 5, 10 and 20 cm. (in both directions). Dry weight (of leaves, stems, roots, reproductive organs) and the total leaf-area were determined. The net-assimilation rate diminished with increasing density of stand.—D.B.

OATS

See also Abs. 1651, 1789, 1790, 1792, 1798, 1800, 1951, 1962, 2013, 2057.

1687† Walkden Brown, C. **Oat varieties for 1959.** *Agric. Gaz. N.S.W.* 1959, **70**, No. 1, 6–10, 50–2, illus., 1 map.

Recommended sowing times, seed rates and fertilizers are given for oats in different parts of N.S.W. Varieties suitable for early or late grazing, grazing and grain or grain alone are listed for each of 12 zones of N.S.W. and for irrigation areas and coastal districts. Notes are given on the 11 varieties recommended.—A.M.H.

1688 Elliott, C. S. **Winter oat variety trials, 1952-56.** *J. nat. Inst. agric. Bot.* 1958, **8**, No. 2, 333–41, bibl. 5.

Thirty-one field trials of Penrhyn, Powys, S147 and S172 winter oats are reported. Penrhyn yielded most, with an average significantly higher than S147, but in some trials it did not stand as well. Powys gave a similar yield to S147 and its straw was shorter and stiffer, being intermediate between S147 and S172 in this respect. F. s. —A.M.H.

1689 Beesley, D. W. and Burrell, W. D. **N.A.A.S./N.I.A.B. spring oat variety trials, 1952-54.** *J. nat. Inst. agric. Bot.* 1958, **8**, No. 2, 310–21, bibl. 3.

The results of 113 trials of spring oats at centres in England and Wales are described. Blenda, Forward, Maldwyn, Star, Eagle, Glasnevin Triumph and Milford were tested against Sun II; the early-maturing Primus and Orion III were tested against Maldwyn. Details of yields, disease resistance, straw length, resistance to lodging and time of maturity are given. No variety gave higher average yields than Sun II or Blenda. Maldwyn, Forward, Primus and Orion III were earlier, but at the expense of lower yields. F. s.—A.M.H.

1690 Bland, B. F. **Spring oat variety trials, 1952-57.** *J. nat. Inst. agric. Bot.* 1958, **8**, No. 2, 297–309, bibl. 5.

The results of 89 trials are reported in which 14 spring oat varieties were compared with Sun II. Comments are made on the relative susceptibility of the varieties to mildew (*Erysiphe graminis*), crown rust (*Puccinia coronata*), black stem rust (*P. graminis*), leaf spot (*Pyrenophora avenae*), take-all (*Ophiobolus graminis* v. *avenae*), stem eelworm (*Ditylenchus dipsaci*) and frit fly (*Oscinella frit*). None of the varieties showed any substantial advantage over Sun II, but Flamande-Desprez and Palu had stiffer straw and Pendek was several days earlier. Civena, Palu, Blanche de Wattines and Sisu gave similar yields to Sun II, but Civena yielded relatively better than Sun II at centres with higher accumulated temperatures. F. s.—A.M.H.

1691 Beesley, D. W. and Burrell, W. D. **N.A.A.S./N.I.A.B. spring oat variety trials, 1955-57.** *J. nat. Inst. agric. Bot.* 1958, **8**, No. 2, 322–32, bibl. 4.

Sixty-four trials of varieties of spring oats, compared with Sun II, are reported. The main varieties were Forward, Lightning, Marne, Minor, Palu and Reagle. Ten trials of the early varieties Primus II and S220, compared with Maldwyn, are also reported. Details of yields, resistance to disease and lodging, straw length and time of maturity are given. No variety was superior to Sun II. F. s.—A.M.H.

1692 Feiffer, P. Zum Mähdrusch des Hafers. **[The combining of oats.]** *Dtsch. Landw.* 1959, **10**, No. 4, 204–6, bibl. 2. [Löderburg über Stassfurt, E. Germany]

When combine-harvesting, the new oat variety Hadmerslebener Auswuchsfester Gelb was superior to Bördeweiss, Goldhafer II and Universal which are the favourite varieties for cultivation in the fertile plain of Magdeburg. This superiority is attributed to greater resistance to (a) lodging, (b) breaking of panicles, and (c) germination on the ear. It is therefore recommended for farms with large areas under oats.—D.B.

1693† Abrams, R. and Frey, K. J. **Effect of recurrent X-radiation on germination and seedling vigor in oats.** *Proc. Iowa Acad. Sci.* 1958, **65**, 174–83. [Iowa Agric. Exp. Sta., Ames, Iowa]

Oat seeds, from ancestors whose seeds had been radiated in 0, 1 and 2 successive generations, with moisture contents of 14·9 and 20·9%, were treated with 40,000r. and 30,000r. of X-radiation, respectively, and were grown in a glasshouse. As the number of preceding irradiated generations increased, germination percentages were progressively reduced in each of the treatments. Similar results were obtained in field tests, where the treatments were 30,000r. and 20,000r., respectively. The vigour of surviving seedlings, as judged by height and dry weight, was greatly impaired where one previous generation was irradiated. Seedling vigour was recovered progressively after succeeding irradiated generations at the higher moisture level, but not at the lower one.—J.D.J.

1694 Wiggans, S. C. and Shaw, R. H. **The effect of high temperatures at varying stages of growth on kernel production in oats.** *Proc. Iowa Acad. Sci.* 1958, **65**, 201–5, bibl. 3. [Iowa Agric. Exp. Sta., Ames]

A range of varieties of oats was grown in a glasshouse during the winter months of 1956–7 and 1957–8, at 70°F., with natural daylight supplemented by incandescent lights to make up a 14-hr. photoperiod. Plants from each variety were placed in high-temperature growth chambers (85, 90, 95 and 100°F.) at 5 different stages of growth (from 3-leaf to heading) for 4 or 8 hr./day for 7 days, then returned to conditions of 70°F. The number of caryopses formed on the primary tiller of each plant increased as the stage of growth adopted for treatment progressed, until the boot stage, when there was a sharp drop and the fewest caryopses were produced. Later treatments showed a recovery in the number of caryopses formed. More caryopses were formed after the 4-hr. treatments than after the 8-hr. ones.—J.D.J.

1695 Wiggans, S. C. **Total nitrogen in normal and blasted oat panicles.** *Agron. J.* 1959, **51**, No. 3, 183. [Iowa Agric. Exp. Sta., Ames]

Five blasted and 5 normal panicles were harvested from each of 114 oat selections. Blasted panicles had 50–75% sterile spikelets; normal panicles less than 20% sterile spikelets. The average weight of grain per panicle was 1·08 g. from normal and 0·45 g. from blasted spikelets, and the N content of the grain 23·6 and 12 mg., respectively. Grain from blasted panicles contained 0·5% more N than normal grain, probably because of the fewer grains per panicle.—R.B.

1696 Norden, A. J. and Frey, K. J. **Factors associated with lodging resistance in oats.** *Agron. J.* 1959, **51,** No. 6, 335–8, bibl. 15. [Iowa Agric. Exp. Sta., Ames]

See also Abs. 594.

1697† Norden, A. J. and Frey, K. J. **Effect of lodging on yield and test weight of oats and establishment of alfalfa seedlings.** *Proc. Iowa Acad. Sci.* 1958, **65,** 190–6, bibl. 7, illus. [Iowa Agric. Exp. Sta., Ames, Iowa]

The experiment was designed to measure losses caused by reductions in the synthesis and translocation of food materials (as opposed to mechanical losses due to harvesting difficulties) as a result of lodging. The oats were allowed to grow through 2-in. wire netting stretched horizontally 18 in. above the ground, and lodging at different angles was achieved by moving this netting in the horizontal plane. The treatments comprised 2 degrees of lodging (45° and 90°), 2 dates of lodging (very soon after heading and about 2 weeks later), and a control with no lodging. Early lodging at 90° was the most harmful treatment in all cases. Losses in yield ranged from 23 to 36%, in bushel weight from 6 to 13%, and in plant population of the undersown lucerne from 11 to 81%.—J.D.J.

1698 Grunes, D. L. and Krantz, B. A. **Nitrogen fertilization increases N, P and K concentrations in oats.** *Agron. J.* 1958, **50,** No. 12, 729–32, bibl. 13. [Soil and Water Conserv. Res. Div., Agric. Res. Serv., USDA]

Oats grown on 4 soils as a winter soil-cover were given a top-dressing of 40 lb. N/ac., 2–3 weeks before the crop was ploughed in at the boot stage. The percentage of N, P and K in the tops, and that of N in the roots, was increased by top-dressing with N, while that of K in the roots was decreased and that of P was not affected. Where 40 lb. N, 29 lb. P and 33 lb. K/ac. were applied in spring, alone, or in different combinations, in aqueous solution 18 or 21 days before the oats were ploughed in, N increased the percentage of P and K in oat tops more than did KP or K, but less than did NPK or (in the case of percentage K) NK. The effect of N in increasing the concentration of P and K in oat tops was considered to be due to increased root growth and nutrient-absorbing capacity.—R.B.

1699 Wiggans, S. C. **The relationship of total nitrogen percentage to yield, test weight and groat percentage of oats grown at different locations.** *Proc. Iowa Acad. Sci.* 1958, **65,** 197–200, bibl. 7. [Iowa Agric. Exp. Sta., Ames, Iowa]

Twelve oat varieties grown at 11 locations in different States were analysed for percentage total N. Highly significant differences were found between varieties (range 2·01–2·70%) and between locations (range 1·91–2·70%), but there was no significant correlation between total N percentage and yield, or groat percentage.—J.D.J.

1700 Sørensen, C. **The influence of nutrition on the nitrogenous constituents of plants. 1. Nitrogen and phosphorus pot experiments with oats.** *Plant and Soil* 1959, **10,** No. 3, 250–65, bibl. 7, illus. [Dep. Soil Fert. and Pl. Nutr., R. Vet. Agric. Coll., Copenhagen, Denmark]

Oats, var. Stål (Steel), were grown in pots each containing 13·5 kg. sandy heath soil, 16 plants per pot, and fertilized with 0, 0·8 or 2 g. N, 0, 0·36 or 0·72 g. P, and 0·98 g. K per pot. Plants were harvested at heading, 3 weeks after heading, or at maturity. The number of tillers produced during the first month after germination was increased by the lower rate of N application. Tiller production at the higher N level was always less than at the lower level. P increased tillering only where N was applied. N applications increased the percentage of N in whole plants, the number of grains per spikelet, total grain yield, and grain yield as a percentage of total dry-matter production. The higher rate of N decreased the 1000-grain weight. The K content of whole plants increased as their N contents increased, except at maturity. The content of NO_3-N in the plants decreased throughout the growing period. The total quantity of N in the grain and of non-nitrate N in the straw increased with increasing N fertilization, and with increasing P fertilization at the high level of N; the latter treatment appeared also to increase total protein yield.—R.B.

1701 Perkins, H. F. and Stelly, M. **Ca and Mg content of oats and crimson clover grown on Norfolk sandy loam as affected by Na and K.** *Soil Sci.* 1958, **86,** No. 6, 305–9, bibl. 15. [Univ. Georgia]

In a plot trial, applications of K and/or Na to the soil reduced the percentages of Ca and Mg in oats.—E.B.O.

1702 Krzysch, G. Der Einfluss steigender Salzkonzentrationen und der Spritztermine auf den Erfolg einer Blattdüngung. [**The effect of**

increasing salt concentration and of spraying time on the success of leaf manuring.] *Z. PflErnähr.* 1958, **83**, No. 3, 214–24, bibl. 2. [Techn. Univ., Berlin]

By increasing the salt concentration of the sprayed fertilizer from 0·15 to 0·6% N and from 0·2 to 0·5% P_2O_5, total yields of oats (grain and straw) and the N and P_2O_5 content of the grain were increased. The best time for spraying was at the booting stage. By increasing the concentration of NH_4NO_3 from 1·7% (corresponding with 0·6% N) to 2·0%, the number of applications of fertilizer could be reduced from 15–20 to 6. Leaf manuring with N or P salts protected oat plants from attack by *Erysiphe graminis*. Six leaf applications of a 2% solution of KH_2PO_4 to early varieties of potato in the early stages of growth hastened the ripening process of tubers, increased their dry-matter content in a given period of time, and brought forward the harvest date by 4–6 days.—D.B.

1703 Department of Agriculture, Republic of Ireland. **Tillage crops [oats].** *Rep. Minist. Agric. Republ. Ire. 1957-8*, Dublin, 1959, 93–5. [Peatland Exp. Sta., Glenamoy, Co. Mayo]

Straw and grain yields on peat land were spectacularly increased by Cu dressings ; the plots without Cu failed almost completely. $CuSO_4$ at 56 lb./ac. was significantly better than 28 lb./ac. as a soil dressing, or 10 lb./ac. as a spray. In a peat-land trial of 10 oat varieties commonly grown in mineral soil, Marne yielded the most (28 cwt. grain and 41 cwt. straw/ac.), followed by Bamboo II. Of varieties commonly grown on peat land, Blenda and Voll were best.—A.M.H.

RYE

See also Abs. 1676, 1789, 1792, 1992, 2057.

1704 Varis, E. Ruislajikkeiden tähkäidäntäherkkyydestä. **The susceptibility of various rye varieties to sprouting in the head.** *Maatal. ja Koetoim.* 1959, **13**, 117–21, illus., English summary. [Exp. Fm Anttila of Hankkija, Hyrylä, Finland]

Sprouting in the ear is an important problem in Finland, especially in late varieties and in wet autumns. In 1958, glasshouse experiments were carried out, using the Hansel sand-bed method, to determine the susceptibility of various rye varieties to sprouting in the ear. The principal Finnish rye varieties, several native or mixed varieties from different parts of Finland and some foreign varieties were tested. The results showed significant differences between varieties in their susceptibility to sprouting in the ear. Ensi, Visa and 01075 were least susceptible to sprouting, whereas most of the unimproved native varieties were more susceptible than Toivo, the control. Of the foreign varieties, the acclimatized Russian variety Vjatka was most susceptible and the Swedish variety Kungs II most resistant. F. Eng. s.—M.H.

1705 Nuttonson, M. Y. **Rye-climate relationships and the use of phenology in ascertaining the thermal and photo-thermal requirements of rye. Based on data of North America and of some thermally analogous areas in the Soviet Union, Finland, Poland and Czechoslovakia.** *Amer. Inst. Crop Ecology* 1958, pp. 219, bibl. 114, 11 maps.

For references to similar articles on barley and wheat, see *Fld Crop Abstr.* 11 : 1435 and 10 : 406.—R.B.

BARLEY

See also Abs. 1672, 1790, 1791, 1792, 1798, 1799, 1800, 1947, 1968, 1991, 2057.

1706 Horváth, P. Vetömagmennyiségi kísérletek három tavaszi árpa fajtával. **Seed-rate experiments with varieties of spring barley.** *Növénytermelés*, 1959, **8**, No. 1, 25–34, bibl. 3, Russian and English summaries. [Nat. Inst. Pl. Variety Test., Budapest]

1707 Dodds, M. E. and Dew, D. A. **The effect of swathing at different stages of maturity upon bushel weight and yield of barley.** *Canad. J. Pl. Sci.* 1958, **38**, No. 4, 495–504, bibl. 12.

Tests with Vantage and Olli barley at Swift Current, Saskatchewan, and Lacombe, Alberta, during the period 1953–7, have shown that these crops can be swathed at a stage of maturity indicated by a kernel-moisture content of 40%. Neither bushel weight nor yield was significantly reduced by cutting at this stage. Swathing can be started 5–7 days earlier than can direct combine-harvesting, and the swath, which lies well on the stubble, can be picked up with a combine-harvester 4 days later.—J.D.J.

1708 Eade, A. J. and Elliott, C. S. **Spring barley variety trials, 1954-57.** *J. nat. Inst. agric. Bot.* 1958, **8**, No. 2, 342–50, bibl. 1.

Fifty-nine field trials of spring barley varieties are reported. Glasnevin No. 3, Ingrid, Pirol, and SAK 22/11 were compared with Proctor. Details of yields, field characters and malting quality are given. Only Ingrid approached the level of yield of Proctor. Short comments are also given on 9 additional varieties for which the results did not justify further trials. F. s.—A.M.H.

1709 Schelling, P. Delta, een nieuw twee-rijig zomergerstras van het Centraal Bureau. **[Delta, a new 2-rowed spring barley from the Centraal Bureau.]** *Meded. nat. coöp. Aan- en Verkoopv. Landb. Cent. Bur.* 1959, **43**, No. 1, 15.

In yield, Delta compares well with other barley varieties grown in the Netherlands. Its straw is stronger than that of Balder, Carlsberg and Minerva, and is of about the same length. The grain is short and well filled, grades well, and ripens slightly earlier than Balder. In a 30-ton sample harvested in 1958, 97·1% of the grains were longer than 2·5 mm. Its value as malting barley has not yet been investigated.—R.B.

1710 Isebaert, L. Onderzoekingen betreffende brouwgerst met het oog op de keuze van de voor de brouwerij en mouterij best geschikte varieteiten. [**Choosing malting-barley varieties best suited for brewing and malting.**] *Het Wetenschappelijk Onderzoek in de Landbouw* 1958, Part 1, 278–84. [Vereniging voor Brouwerijonderzoek en Onderwijs]

In varietal trials, Balder yielded 4%, Herta 8%, Proctor 10% and Carlsberg 12% more grain than Kenia. A sowing rate of 90–110 kg./ha. is recommended.—R.B.

1711 Tihonova, N. A. [**Utilizing the sun's energy to control loose smut (*Ustilago* sp.) on winter barley in the Crimea Province.**] [Russian] *Doklady Vsesojuz. Akad. S-H Nauk (Proc. Lenin Acad. Agric. Sci.)* 1959, **24**, No. 5, 38–40.

1712 Jansson, G. and others. **Studies in barley and malt. 13. Water-sensitivity as an intrinsic property of certain barleys.** *J. Inst. Brew.* 1959, **65**, No. 2, 165–8, bibl. 10. [Brewing Industr. Res. Found., Nutfield, Surrey]

The phenomenon of water sensitivity in barley grains is recognized by their failure to germinate when the amount of water present exceeds the minimum necessary to permit germination. Water sensitivity in barley is an intrinsic property, it varies with variety and can be eliminated by removal of the outer skins of the grain. In the trials reported, it was shown that the phenomenon was not due to the inhibition of germination by micro-organisms.—P.J.B.

1713 Radley, Margaret. **The occurrence of gibberellin-like substances in barley and malt.** *Chem. and Industr.* 1959, No. 27, 877–8, bibl. 8. [I.C.I., Akers Res. Lab., The Frythe, Welwyn, Herts]

The extracts of samples of Proctor barley, taken at different stages of the malting process, showed gibberellin-like activity when applied to leaves of pea seedlings. There was apparently an increase in this activity as the grain was converted into malt.—E.B.O.

1714 Pleshkov, B. P. and Fowden, L. **Amino-acid composition of the proteins of barley leaves in relation to the mineral nutrition and age of plants.** *Nature, Lond.* 1959, **183**, No. 4673, 1445–6, bibl. 20.

1715 Marschner, H. Einfluss von P^{32} auf die Entwicklung und den Ertrag von Sommergerste. [**Effect of ^{32}P on development and yield of spring barley.**] *Biol. ZBl.* 1959, **78**, No. 2, 334–41, bibl. 10, illus. [Agric. Chem. Inst., Univ. Jena, E. Germany]

1716 Caldwell, F. and Hampson, G. **Germination of acid-treated samples as a means of assessing mechanical damage of barley.** *J. Inst. Brew.* 1958, **64**, No. 4, 319–26, bibl. 6. [Nat. Inst. Agric. Engng, Silsoe, Beds.]

Undamaged samples of Proctor barley harvested in 1956 at 18% or 25% moisture were treated with 50% (v/v) aqueous H_2SO_4 for 3 hr. at 20–21°C. immediately prior to germination tests, which were made at harvest and 1 yr. later [see *Fld Crop Abstr.* 11 : 506]. Storage for 1 yr. had no effect on the resistance of the undamaged grain to attack by acid. Samples of Proctor, combine-harvested at 25% moisture, 5 threshing cylinder speeds and 5 concave clearances, and acid-tested in Dec., May and Oct., showed significantly greater percentage germination than similar acid-tested samples harvested at 18% moisture. Percentage germination following acid treatment decreased as the cylinder speed increased and as the concave clearance, with the exception of the 2 narrowest settings, decreased. The percentage germination of grain harvested at the narrowest clearance was relatively high in Dec. tests, but fell sharply in May tests. It was suggested that bruising of the grain occurred at the narrowest concave clearance. The interaction between concave clearance and harvest moisture level was highly significant in Dec. tests, less significant in May, and non-significant in Oct. Acid treatment had little effect on shoot growth.—R.B.

1717 Bullen, E. R. **Nitrogen content of barley grain. An examination of the percentage of nitrogen in barleys grown in the Eastern Region and the effect of late top dressing with "Nitro-Chalk."** *Exp. Husb.* 1959, No. 4, 28–33, bibl. 5. [NAAS Crop Husb. Dep., E. Region]

1718 Larter, E. N. and Whitehouse, J. **A study of yield and protein response of malting barley varieties to different fertilizers.** *Canad. J. Pl. Sci.* 1958, **38**, No. 4, 430–9, bibl. 9. [Dep. Field Husb., Univ. Saskatchewan, Saskatoon, Saskatchewan]

The effect of fertilizers on yield, protein percentage and diastase activity of Montcalm, O.A.C. 21 and Olli malting barley was studied during 1952–7. Fertilizer treatments in the first 4 years included 11–48–0 (NPK) at 20 and 40 lb./ac., 16–20–0 (NPK) at 72 and 96 lb./ac. and NH_4NO_3 at 60 lb./ac. In the last 2 years, NH_4NO_3 was omitted and the mixed fertilizer rates were in-

creased to 40, 60, 80 and 100 lb. of 11–48–0/ac. and 96, 120 and 144 lb. of 16–20–0/ac. Yield increases were substantial, except that O.A.C. 21 and Olli did not respond to NH_4NO_3. Protein percentage and diastase activity of Montcalm and O.A.C. 21, but not of Olli, were increased by the mixed fertilizers in 3 years out of 5. Varietal fluctuations in diastase activity were similar to those for protein percentage. The magnitude of the protein increase was not considered sufficient to have an adverse effect on malting quality. F. s.—J.D.J.

MAIZE

See also Abs. 1947, 1951, 1968, 2057, 2064.

1719† Kavanagh, L. R. **Maize-growing in New South Wales.** *Agric. Gaz. N.S.W.* 1958, **69,** No. 11, 561–9, illus. ; and 1959, **70,** No. 1, 30–6, illus.

1720 Bunting, E. S. and Willey, L. A. **The cultivation of maize for fodder and ensilage. 2. The effect of changes in plant density.** *J. agric. Sci.* 1959, **52,** No. 3, 313–9, bibl. 14. [Agric. Res. Coun. Unit Exp. Agron., Oxford, and Nat. Inst. Agric. Bot., Cambridge]

Maize of several varieties, comprising material of early, medium-early, medium-late or late maturity, was grown for 6 yr. at 2 locations from May to Oct. in 24–27-in. rows at plant densities varying from 4 to 16 plants/sq. yd. Plant density had little effect on earliness, plant height or chemical composition. Increasing plant density increased yields of dry matter and decreased the percentage contribution of maize ears towards the total dry weight. Tall, late varieties tended to produce more dry-matter at low plant densities than did earlier varieties. A greater percentage of lodging and of infertile ears occurred at high plant densities. Early hybrids were less susceptible to lodging than later varieties. For fodder or silage, hybrids intermediate in maturity between Wisconsin 275 and Wisconsin 341A were recommended, to be grown at a density of 9–12 plants/sq.yd.—R.B.

1721 Laird, R. J. and Lizárraga, H. H. Fertilizantes y población óptima de plantas para maíz de temporal en Jalisco. [**Fertilizers and optimal plant density for maize grown in the rainy season in Jalisco (Mexico).**] *Fol. téc. 35 Sec. Agric. Ganad., Méx.* 1959, pp. 63, bibl. 19, illus., English summary.

An account is given of trials carried out in 1954 in 15 localities (altitude 300–1850 m.a.s.l.) in the maize belt of Jalisco, where the annual rainfall is 800 mm., or more. In this region the yields of unmanured maize do not exceed 5·5 tons of ears per ha. The application of 80 kg. N/ha. increased yields of ears by 1·43–2·86 tons/ha., in 13 localities. The additional increase in yield obtained by raising the application of N from 80 to 120 kg./ha. was economical in 9 out of 10 localities, and in 7 out of 10 applying half the N at sowing and half as a side-dressing at the time of the last weeding was more effective than applying it all at sowing. The optimal plant density varied from 20,000 plants per ha. in unmanured maize to 45,000 plants in maize dressed with 120 kg. N/ha.—E.B.O.

1722 Runge, E. C. A. and Odell, R. T. **The relation between precipitation, temperature and the yield of corn on the Agronomy South Farm, Urbana, Illinois.** *Agron. J.* 1958, **50,** No. 8, 448–54, bibl. 12. [Illinois Agric. Exp. Sta., Urbana]

Multiple correlation techniques were used on maize yields from 1903 to 1956 at Illinois, to determine : (a) the relationship between maize yield, precipitation and daily maximum temperature, and (b) the duration and starting dates for given temperature and precipitation which were associated with the greatest variability in maize yields. Results were as follows : (a) maize yields were influenced most markedly by precipitation preceding anthesis and by maximum temperature during anthesis. The latter effect probably includes that of low precipitation which is often associated with high temperatures ; (b) a period from 50 to 74 days before anthesis to 14 to 30 days following anthesis explained 67% of the corn yield variability. It was concluded that precipitation above normal is especially beneficial when it occurs approximately one month before and during anthesis, and that the frequency and magnitude of moisture deficiencies during this period should be investigated as a basis for determining the economics of supplementary maize irrigation.—J.E.T.

1723 Collier, D. and others. Réaction des plantes cultivées aux conditions de sous-sol: essais sur maïs grain. [**Reaction of crops to subsoil conditions : trials with grain maize.**] *C.R. Acad. Agric. Fr.* 1958, **44,** No. 12, 610–16, bibl. 2.

An account is given of the 6th year of trials in vegetation tanks at the Agronomy Station of the Central Massif, France. The grain yields of maize were lowest (2320–2570 kg./ha.) where the maize was grown in 85 cm. of black earth overlying 60 cm. gravel where the effect of organic manure was negligible because of water deficiency. Yields were double on 145 cm. of earth, or on 30 or 60 cm. of earth over a clay subsoil, and treble on 145, or more, cm. of earth with a water table at depths of 120 or 190 cm. Yields were intermediate (about 6000–6200 kg./ha.) on 145 cm. of soil with sprinkler irrigation or with a water table at a depth of 60 cm. Data are given of the chemical composition of the grain, leaves and straw. The grain and leaves of maize grown where the water table was near the

surface (60 cm.) had a low N content. [See also *Fld Crop Abstr.* 11 : 509.]—E.B.O.

1724 Rumbaugh, M. D. **Test weight and maturity of corn.** *Agron. J.* 1959, **51,** No. 5, 307, bibl. 3. [Colorado Agric. Exp. Sta., Fort Collins]

In field trials with commercial maize hybrids, average yields and grain moisture-contents were higher in years with 143- and 155-days' growing seasons than in years with a season of 121 days. The interval between sowing and 50% silking was erratic in relation to the length of season. The negative correlation between yield and percentage grain moisture-content decreased in magnitude as the length of the growing season increased. There was a higher correlation between yield and bushel weight than between yield and time for 50% silking. Bushel weight was considered to be a more satisfactory indication of the relative maturity of maize hybrids than was the date of silking.—R.B.

1725 Bunting, E. S. and Willey, L. A. **Studies on maize for grain production. 1. Variety trials.** *J. nat. Inst. Bot.* 1958, **8,** No. 2, 364–77, bibl. 6, illus. [Agric. Res. Counc. Unit of Exp. Agron., Oxford and NIAB, Cambridge]

The results are given of 50 trials of 55 grain maize varieties grown in S. England in 1953–7. Yields of dry grain were obtained in 28 trials. Considering both earliness and productivity, the most suitable varieties were the Dutch flint × dent hybrids, Prior and Matador, and the Dutch experimental hybrids CB.45 and CB.47. Details are given for 35 varieties on grain production, date of pollen-shedding, moisture content of grain, plant and ear height and extent of lodging. There are brief accounts of different methods of presenting comparable information from incomplete trial data, and of annual effects on the productivity and earliness of grain maize. F. s.—A.M.H.

1726 Cauderon, A. Les maïs-hybrides en France. Étude de la précocité. [**Maize hybrids in France. Study of their earliness.**] *Ann. Amélior. Pl., Paris* 1958, **8,** No. 3, 273–89, bibl. 4, illus., English, Russian and German summaries. [Sta. Amélior. Pl., Clermont-Ferrand, France]

The growing of grain-maize in France, which was confined to the south-west and a small area in the east, is spreading to many other regions, but is restricted in the north by insufficient warmth in summer. The geographical distribution of maize varieties is based mainly on their earliness. The number of days to maturity, which varies with the climate, is not a good measure of earliness, the best measure being the total of the average daily temperatures above a threshold of + 6°C. between sowing and maturity (moisture content of the grain 35%). The maize hybrids grown in France, where the favourable period for this crop is 1 May–30 Sept., are classified on this basis, with reference to the international indexes of earliness. In the region Paris-Loire, where the temperature is lower than in the traditional maize-growing areas, maize varieties which are intermediate between W 240 and W 355 (earliness 300) mature satisfactorily.—E.B.O.

1727† Nissen, Ø. and Skaland, N. Forsøk med grønnfôrmais. **Trials with green maize.** *Forskn. Fors. Landbr.* 1958, **9,** No. 4, 315–29, bibl. 12, English summary.

The results are given of trials during 10 years in south-east Norway. In trials with 25 varieties during 1948–52, Wisconsin 240 gave higher dry-matter yields than any other variety except Pioneer 355, Pioneer 389 and Crows 260, which gave higher yields in 4 trials in 1950. In trials with 24 varieties in 1953–7, dry-matter yields of Kingscrost KF were higher than those of all other varieties, except Goudster and Caldera 331 in 4 trials in 1957. In sowing-date trials, 3 dates, mostly falling within the period 11 May–10 June, were used. In almost all cases, early sowing resulted in highest yields. With Kingscrost KF and Wisconsin 240, each day's delay in sowing resulted in respective decreases of 1·9 and 1·6% in dry-matter yields. Sowing rates of 8–10 kg./decare, in rows spaced 40–60 cm. apart, gave the best economic returns. In comparative trials, marrow-stem kale gave 20–30% higher dry-matter yields than Wisconsin 240 or Kingscrost KF maize. Data are given of the chemical composition and digestibility of maize silages.—P.J.B.

1728 Schaik, T. van. **Performance of South African maize variety crosses.** *S. Afr. J. agric. Sci.* 1958, **1,** No. 4, 423–33, bibl. 5, French and Afrikaans summaries. [Agric. Res. Inst., Pretoria]

The results are given of yield trials of 15 South African maize varieties and all the crosses between them, carried out in each of 5 localities in 1956–7. F. s.—A.M.H.

1729 Graner, E. A. and Ferraz, T. F. Milho : estudo comparativo entre variedades, híbridos, sintéticos e híbridos de sintéticos. [**Maize. Comparative study of varieties, hybrids, synthetic varieties and hybrids of these.**] *Rev. Agric., Piracicaba* 1959, **34,** No. 1, 51–65, bibl. 16, English abstract. [Esc. Agric. Luiz de Queiroz, Univ. S. Paulo, Brazil]

1730 Longchamp, R. and Faivre-Dupaigre, R. Essais de désherbage du maïs avec la simazine. [**Weed-control trials in maize using simazin.**] *Meded. LandbHogesch. Gent* 1958, **23,** Nos. 3 and 4, 1016–24. [Inst. Nat. Rech. Agron., Versailles, and Assoc. Gén. Prod. Blé et autres Céréales, Paris]

Optimum yields of maize grain were obtained on weedy plots at 4 locations where simazin was applied at 2–3 kg./ha. Hand-weeded controls gave consistently lower yields than treated plots. At one location where hail fell 13 days after treatment with simazin, control plots developed normally, but herbicide damage occurred to the crop in the treated plots in proportion to the amount applied. Species of *Panicum* and *Setaria* were effectively controlled by simazin, *Digitaria* spp. not so well. At 2 locations, susceptible weeds were controlled, but plots were invaded by resistant weeds such as *Convolvulus arvensis* and *Cynodon dactylon*. Maize plots remained weed-free until harvest on all plots where control was achieved. Simazin was fatal to beet, rape, winter barley, rye and wheat sown 4 months after treatment of the preceding maize crop. —R.B.

1731 Pathak, C. H. **Effect of pre-emergence treatment with 2,4-D on weeds in corn and on various soil properties.** *Indian J. Agron.* 1958, **3**, No. 2, 99–108, bibl. 26. [Agronomy Farm, Rosemount, Minnesota, USA]

There were 3 main weed control treatments : (1) cultivating twice with a rotary cultivator ; (2) cutting weeds to ground level without cultivating ; (3) pre-emergence spraying with 1·5 lb. 2,4-D/ac. Each treatment was given alone and in combination with 20 and 40 lb. N/ac. The effect of these treatments on maize yield and on nutrient and moisture content of maize and soil were determined. Treatments (1) and (2) were superior to (3).—D.B.

1732 Nicholson, F. J. **Maize seed treatment with fungicidal dusts in the Tumut district.** *Agric. Gaz. N.S.W.* 1959, **70**, No. 1, 37–8, 42.

The effects of seed-dressing with copper carbonate, fernasan, agrosan, ceresan and tetroc dusts, all at 1 oz./bu., on the establishment and yield of Emblem hybrid maize were investigated. Only tetroc (not commercially available, but identical with coversan) consistently improved both germination and yield.—A.M.H.

1733† Crosier, W. F. **Relation of pericarp injuries of corn seed to cold test germination.** *Proc. Ass. off. Seed Anal. N. Amer.* 1958, **48**, 139–44, bibl. 12. [New York State Agric. Exp. Sta., Geneva, New York]

The addition of arasan or captan to commercial maize seed stocks increased seedling protection, indicating that these stocks were not sufficiently treated to protect the seed fully under cold-soil conditions. Under moderately severe cold-test conditions, arasan and captan gave equal protection from decay. Pericarp breaks could be revealed by staining with Fast Green. The inverse relationship of pericarp damage to percentage germination provides a good indication of the performance of a seed sample in cold soil.—J.D.J.

1734† Alder, E. F. and others. **Effects of gibberellic acid on corn (*Zea mays* L.).** *Agron. J.* 1959, **51**, No. 5, 307–8. [Eli Lilly Res. Lab.]

Maize, var. Pioneer No. 395, was treated with 1 or 3 mg. GA prior to tasseling, at 30% tasseling, or at complete tasseling, in all combinations. GA had no effect on the weight of plants cut for silage 4 weeks after treatment, nor on the yield of grain at maturity, but it increased the height of all plants treated ; treatment at 30% tasseling had the greatest effect.—R.B.

1735 Harrold, L. L. and others. **Transpiration evaluation of corn grown on a plastic-covered lysimeter.** *Proc. Soil Sci. Soc. Amer.* 1959, **23**, No. 2, 174–8, bibl. 8, illus. [Soil and Water Conserv. Res. Sta., Coshocton, Ohio]

Maize grown in a lysimeter whose soil surface was covered with plastic sheeting used 8·5 in. of water during the growing season and yielded at the rate of 125 bu. grain/ac., compared with 169 bu./ac. where grown in an uncovered lysimeter and 182 bu./ac. where grown in a covered lysimeter to which a volume of rain-water equivalent to precipitation was added. It was estimated that 44% of the total seasonal evapotranspiration was due to transpiration and 56% to evaporation. The ratio between soil evaporation from the uncovered lysimeter and free-water evaporation decreased during the growing season as the amount of soil shading by the maize leaves increased. The water-use efficiency for maize on the covered lysimeter not receiving rain-water was 904 lb. dry matter per in. of water used, compared with 676 lb./in. on the uncovered lysimeter.—R.B.

1736 Shaw, R. H. **Water use from plastic-covered and uncovered corn plots.** *Agron. J.* 1959, **51**, No. 3, 172–3, bibl. 3. [Iowa Agric. Exp. Sta., Ames]

Maize grown in soil covered by black plastic sheeting intercepted 0·13–0·19 in. of water during rains of more than 0·3 in. The loss of soil moisture was 46% of that from uncovered plots. When intercepted water as well as soil-moisture loss was calculated as total water loss, the water loss from covered compared with that from uncovered plots was 90% when solar radiation was 250 cal./sq.cm./day, and 72% when solar radiation was 550 cal./sq. cm./day. F. s.—R.B.

1737 Crane, P. L. **Factors associated with varietal differences in rate of field drying in corn.** *Agron. J.* 1959, **51**, No. 6, 318–10, bibl. 2 in text. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

A number of maize hybrids all of which reach the silk stage and subsequently reach a grain mois-

ture content of 45% at approximately the same time, but the grain of which dries at different rates, were investigated to determine the factors which influence the rate of grain drying. The flow of moisture into the ears from the plant, the length and width of husks, number of husks per ear, the number of husks which split during drying, shank length and ear dimensions were not consistently associated with varietal differences in rate of grain drying in the field or in a current of air at 100°F. When tested in sucrose solutions whose concentrations varied from 0 to 2·5 M, hybrids with rapid-drying grain were shown to have a slightly, but consistently, lower grain osmotic diffusion pressure, and a pericarp considerably more permeable to moisture than hybrids with slow-drying grain.—R.B.

1738† Tsotsis, B. **The use of thermal and photothermal units for describing flowering and maturation in maize.** *Diss. Abstr.* 1959, **19**, No. 6, 1156–7. [Univ. Wisconsin, Madison]

Thermal and photothermal units were recorded daily during 3 growing seasons. Thermal units were obtained by averaging the daily maximum and minimum temperatures and subtracting 50°F. from the figure obtained. Photothermal units were obtained by multiplying the daily thermal units by the daily duration of light (including civil twilight). The sum of thermal and photothermal units from sowing to flowering and maturation was used as an index for assessing the earliness or lateness of maize varieties. For the 10 varieties studied, the number of thermal and photothermal units from sowing to flowering differed significantly from season to season. Certain varieties behaved as if their thermal and photothermal requirements were relatively stable ; the requirements of others appeared to be relatively variable. Thermal and photothermal units were positively correlated ($r = > \cdot 9$) and appeared to provide, essentially, the same information. Thermal units were thought preferable to photothermal units by reason of their ease of computation. Irrespective of earliness or lateness, varieties responded similarly to thermal-unit accumulation in terms of the decline in the moisture content of the grain during maturation. Accumulated thermal units had a lower coefficient of variability and were considered to be superior to calendar days as an index of flowering and maturation in maize.—P.J.B.

1739 Stepanov, V. N. and Satilov, I. S. [**The main results of work with maize in the Department of Plant Industry and the Field Husbandry Experiment Station of the Timirjazev Agricultural Academy.**] [Russian] *Izv. Timirjazevsk. S.-H. Akad.* (*Bull. Timirjazev agric. Acad.*) 1959, No. 1, (26), 59–88, bibl. 13, English summary.

The recent trend towards utilizing maize, not only for grain but also for silage, by cutting the crop at the wax or milk/wax stage when the yield of dry matter and fodder units is at its maximum, has raised the possibility of extending the sowings of this crop in the northern and eastern regions of the USSR, and also in the central areas of the non-chernozem belt. Compared with the chernozem zone, the conditions in these more northerly areas are characterized by less intense solar radiation, a relatively short frost-free period with moderate temperatures, longer days in summer, and increased moisture of air and soil. Studies of maize for these conditions have involved extensive research into the crop's biology which is discussed in regard to : (a) the plant's need for warmth at different phases of development ; (b) formation of generative organs, flowering and ripening ; (c) hardiness of the plant and its resistance to frost ; (d) the root system ; (e) choice of varieties for the non-chernozem belt ; (f) maize as a fallow crop ; (g) the influence of fertilizers on yields ; (h) sensitiveness of maize to tillage ; (i) effect of date and method of sowing on yields ; and (j) sowing maize with leguminous plants.—M.H.

1740 Bennett, W. F. **Effect of nitrogen on phosphorus absorption by corn.** *Diss. Abstr.* 1959, **19**, No. 6, 1152. [Iowa State Coll., Ames]

In field trials, increasing the rate of applied N, in the presence of applied P, increased the percentage of N in the 6th leaf of maize plants ; the effect on the N percentage in the whole plant was less consistent. Increasing N applications also increased the translocation of P from the vegetative parts of the plants to the grain. In glasshouse trials in which maize was grown in sand cultures, nitrate-N was significantly superior to ammonium-N in its effect on plant growth ; the latter appeared to be toxic when applied in large amounts. In all trials, increasing levels of N supply increased the content of all water-soluble N fractions, except the NH_4^+ and NH_2^- fractions, which increased only in plants grown in sand cultures. Non-water-soluble N also increased in all cases. The contents of NH_4^+ and NH_2^- fractions were very low in leaves and stalks ; that of nitrate-N was high in the stalks, but not in the leaves. The P present in the plants was almost all in the water-soluble form.—P.J.B.

1741 Bonnet, J. A. and others. **Yield responses to different NPK levels, and correlations with foliar analysis, in sand-culture studies with corn, sugarcane and cotton.** *J. Agric. Univ. P.R.* 1958, **42**, No. 3. 168–84, bibl. 8, illus., Spanish summary.

Yield data are given for sweet-corn, dent maize and cotton, grown in sand culture in glasshouses, and receiving various levels of N, P and K.

The content of major nutrients in leaves at specific crop ages could be used to predict relative yield values ; for maize these ages were 25–65 days for N and 18–65 days for P and K.—R.B.

1742 Parks, W. L. and Knetsch, J. L. **Corn yields as influenced by nitrogen level and drouth intensity.** *Agron. J.* 1959, **51,** No. 6, 363–4, bibl. 16. [Tennessee Agric. Exp. Sta., Knoxville]

Maize was grown for 3 yr. of differing rainfall at N rates ranging from 30 to 150 lb./ac. Respective yields for the 3 yr. ranged from 17 to 26, 103 to 138 and 61 to 80 bu./ac. By means of least square regression methods, a relationship between maize yields, N level, and severity of drought at different stages of growth was established.—R.B.

1743 Younts, S. E. and Musgrave, R. B. **Chemical composition, nutrient absorption and stalk rot incidence of corn as affected by potassium fertilizers.** *Agron. J.* 1958, **50,** No. 8, 426–9, bibl. 15. [Cornell Univ., Ithaca, New York]

Three field experiments and 2 pot experiments were conducted to study the effects of Cl in K fertilizers on maize. The percentage of P in maize leaf tissue in field experiments was not affected greatly by Cl, but P uptake in pot experiments was depressed by high Cl applications. The rate of Cl at which this effect was observed seemed to be influenced by the relative placement of Cl and P in the soil. Total N uptake and uptake of NO_3 was depressed by high rates of Cl. Cl did not affect K and Ca uptake, but increased Mg uptake. Cl absorption was directly related to the amount applied. Increasing rates of KCl decreased the incidence of stalk rot, while increasing K_2SO_4 and KPO_3 applications had little or no effect. A relatively close correlation existed between the percentage of plants with stalk rot and the percentage of Cl in the ear leaf. F. s.—J.E.T.

1744 Baird, B. L. and Mason, D. D. **Multivariable equations for fertility-corn yield response surfaces and their agronomic interpretation.** *Agron. J.* 1959, **51,** No. 3, 152–6, bibl. 6. [N. Carolina Agric. Exp. Sta., Raleigh]

Fertilization experiments using different levels of N, P and K were carried out with Dixie 82 maize on 2 soils at 19 locations in 1955 and at 21 locations in 1956, and results were analysed by means of polynomial equations and equal-yield contour graphs. Increases in yield resulted from N applications at all of 23 locations on soil poor in organic matter, and at 10 out of 17 locations on soil rich in organic matter. Increases in yield due to P and K occurred at 7 locations on the latter soil and at none on the former. F. s. —R.B.

1745 Younts, S. E. and Musgrave, R. B. **Growth, maturity, and yield of corn as affected by chloride in potassium fertilizer.** *Agron. J.* 1958, **50,** No. 8, 423–6, bibl. 16. [Cornell Univ., Ithaca, New York]

The effect of Cl and K fertilizers on the growth of maize was measured by applying different levels of K in the form of chloride, sulphate and phosphate. Two methods of application were used for the chloride and the sulphate : (a) band-placement 3 inches to one side and slightly below seed level in the row at sowing, (b) broadcasting before sowing, followed by harrowing. No difference in time of germination was evident under any treatment. At the high rate of application (120 lb. K_2O/ac.), the phosphate form gave the best growth, maturity and yield while the chloride form applied in rows was worst. The deleterious effect of KCl on plant growth was less when broadcast than when band-placed, though at low rates (20 lb. per ac.), band-placed KCl produced the best results. Small amounts of Cl appeared to be beneficial ; the level of Cl application is probably critical in the case of maize.—J.E.T.

1746 Struve, W. M. **Drying and germinability of maize.** *Diss. Abstr.* 1959, **19,** No. 9, 222. [Iowa State Coll., Ames]

Maize seed with a moisture content of over 25% when harvested showed reduced viability when subjected to rapid drying. Such seed damage was greatest in seed with a moisture content in the range 40–30% before drying. Storing completely dry seed at low temperatures in O_2-free conditions resulted in the maintenance of vigour and viability for long periods; seed with 4% moisture content stored under the same conditions preserved its vitality almost as well as completely dry seed.—P.J.B.

1747 Salmond, K. F. **A guide to the safe storage of maize.** *Agric. Bull. 16 N. Rhod. Dep. Agric.* 1959, pp. 44, illus., bibl. 9, 2s.

1748 Fenaroli, L. **Technical problems of corn growing in Italy.** *Euphytica* 1958, **7,** No. 3, 228–36, Dutch summary. [Sta. Sper. Maiscoltura, Bergamo, Italy]

The acreage devoted to hybrid maize in Italy has increased from 0·1% in 1948 to 28% in 1957. The average annual yield is more than 35 bu./ac. and the total production since 1953 has remained steady at over 115 million bu., approximately adequate for Italy's needs. Hybrid seed production has become of great economic importance. The hybrids I.A.B. 300 and Insubria 295 have given good results in central and S. Italy, but in the north there is need for hybrids adapted to a short growing season and suitable for human consumption. Information is given on breeding re-

quirements and on current research on phytopathological and cultural problems. The last-named include the selection of varieties for different environments and crop rotations, the determination of optimum plant populations, manuring, sowing methods and mechanization.—G.M.R.

SWEET-CORN

See also Abs. 1741.

1749 Cameron, J. W. and Cole, D. A., Jr. **Weather pattern effect on corn.** *Calif. Agric.* 1958, **12**, No. 11, 4–5, illus.

A study was made of cases of failure to set seed in early-season sweet-corn in the Coachella Valley, California. In most ears containing undeveloped grain, the silks from the ovules had grown within the husks, instead of emerging in the normal way. Most of the affected ears occurred in plots which silked during a period of abnormally hot weather when temperatures of 103–108°F. were recorded. It was suggested that drying of the husks was responsible for the failure of the silks to emerge.—R.B.

SORGHUMS AND OTHER MILLETS

See also Abs. 1957, 2047, 2057.

1750 Jayaraman, M. V. and Balasubramanian, C. **Soil moisture and growth of cholam Co. 1.** *Madras agric. J.* 1958, **45**, No. 12, 469–70. [Agric. Meteor. Sect., Res. Inst., Coimbatore]

Unevenness of stand of sorghum was studied. At sampling points (selected for the difference in growth of the sorghum crop from the average stand) plant height and root depth and spread were recorded and tabulated against soil moisture at 3 soil depths (0–3, 3–6, 6–12 in.). There were variations in root development in different parts of the same field, the cause of which will be investigated. Roots did not penetrate below 12 in. whether grown in a field of black clay or red loam soil; this suggests that if sorghum is grown under irrigation, it is sufficient to moisten the top foot of soil.—D.B.

1751 Thompson, L. **Sorghum versus sorghum-guar mixtures for forage and protein production.** *Proc. Okla Acad. Sci.* 1958, **38**, 31–2.

Data from plots on which *Sorghum vulgare* was grown for silage, alone, or with *Cyamopsis tetragonoloba*, indicated that the legume did not contribute sufficient additional protein to compensate for the reduction in forage yield which occurred in the mixed stand.—H.L.B.

1752 Consolani, E. Una pianta vittoriosa contro la siccità : il sorgo ibrido da granella. [**A drought-resistant crop : hybrid sorghum for grain.**] *Progresso agric.* 1959, **5**, No. 4, 467–9, illus.

The hybrid sorghum S-1, tested in various regions of Italy, is suitable for dry, hilly areas. Sown in Apr.–early May and harvested in late Aug.–Sept., it yields up to 10,000 kg. of grain per ha.—E.B.O.

1753 Edwardson, J. R. and Molyneux, J. **Protecting grain sorghum from bird damage.** *Agron. J.* 1958, **50**, No. 8, 494–5, bibl. 3. [Florida Agric. Exp. Sta., Gainsville]

Six combinations of anthraquinone, hydrated lime, sulphur and arasan 75, with 4 colouring materials, viz. red and black cement pigments, methylene blue and brilliant red, were applied in the form of dusts and sprays to the heads of 13 sorghum hybrids and Early Hegari sorghum in an attempt to control damage by red-winged blackbirds [*Agelaius phoeniceus*], sparrows [*Passer domesticus*] and boat-tailed grackles [*Cassidix mexicanus major*]. The 4 chemicals repelled birds during 5 days' testing. The 4 colouring materials repelled birds for periods of 3–4 days. A dust containing dried blood, bentonite, anthraquinone and red cement pigment was the only treatment giving complete protection. Seeds from each row of the plot treated with this dust were compared with seeds from a cage-protected plot ; germination percentages from dust-treated plots varied from 32–82, those from the control varied from 78–98 ; average germination percentages were 69·2 and 90·5 respectively. Of 1400 control seed, 134 failed to germinate, of which 11 were mouldy ; of 1400 dust-treated seed, 542 failed to germinate and all of these were mouldy. The dust appeared to supply a medium favourable for the growth of fungi.—R.B.

1754† Tejwani, K. G. and others. **Deficiency of iron in black cholam (*Andropogon sorghum*).** *Indian J. Agron.* 1958, **3**, No. 2, 118. [Cent. Tobacco Res. Inst., Rajahmundry, Andra Pradesh]

In the Madurai district of S. India, especially in rainfed areas, symptoms of chlorosis appeared in *Sorghum vulgare* 2 weeks after germination. Spraying with 225 lb. $FeSO_4$/ac. brought about an immediate recovery.—D.B.

1755 Stanway, Viola. **Prechilled *v.* non-prechilled germination of *Sorghum vulgare* Pers.** *Proc. Ass. off. Seed Anal. N. Amer.* 1958, **48**, 93–5, bibl. 3. [Dep. Fld Crops, Univ. Missouri, Columbia, Missouri]

Better germination was obtained where the seed was not chilled before testing.—J.D.J.

1756† Lan, J. Z. **Developmental morphology and histogenesis of reproductive structures of the millet, *Panicum miliaceum* L. 1. Developmental morphology of the inflorescence and flower.** [Chinese] *Acta bot. sinica* 1958,

7, No. 4, 203–14, bibl. 20, illus., English summary. [Northwestern Normal College, Lanchow, China]

The change from the vegetative to the reproductive phase in *P. miliaceum* occurs after the production of the 14th or 15th leaf. An account is given of the changes which take place in the shoot apex during the formation of the branches of the panicle, the spikelets, florets and floral parts. F. Eng. s.—D.B.

1757 Danil'čuk, P. V. [**The biology of flowering in *Setaria italica* (L) P.B. under conditions of the southern Ukraine.**] [Ukrainian] *Ukr. bot. Ž., Kiev (Ukrainian Bot. J.)* 1959, **16,** No. 2, 52–9, bibl. 12, illus., Russian and English summaries.

Experiments on the biology of flowering of Italian millet, *Setaria italica,* were conducted on irrigated and non-irrigated plots of the All-Union Institute of Selection and Genetics (Odessa). The effects of temperature, humidity and soil moisture reserves on the nature of flowering and fruit formation were studied. There is evidence that the time, duration and degree of flowering depend on variety and environment ; the number of grains formed depends on soil moisture. F. Eng. s.—M.H.

RICE

See also Abs. 1798, 1970, 2057.

1758 Gallais, J. La riziculture de plaine en Haute-Guinée. [**The growing of swamp rice in Upper Guinea (French West Africa).**] *Ann. Géogr.* 1959, **68,** No. 367, 207–23, bibl. in text, illus.

Information is given on the growing of swamp rice in Upper Guinea, which started after the first world war and covers now about 23,800 ha. The rice, sown in June, is grown in water supplied by rainfall and by floods from rivers (primarily the Niger). The different varieties used are adapted to varying conditions determined by date of flooding and depth of water.—E.B.O.

1759 Mouton, J. and Merny, G. La riziculture en pays Bété et le faux-charbon du riz. [**Rice-growing in Bété country (southern Ivory Coast) and smut of rice.**] *Riz et Rizicult.* 1959, **5,** No. 1, 30–6, bibl. 20, illus., English and Spanish summaries.

Information is given on the growing of upland rice in Bété country, mainly on hill slopes. The number of panicles per sq. m. was found to range from 50 to 125. The varieties grown belong to the Japonica, Indo-Japonica and Indica groups. Advice is given on measures for controlling smut (*Ustilaginoidea virens*).—E.B.O.

1760 Bordas, A. J. Développement de la culture du riz à Cuba. [**Development of rice-growing in Cuba.**] *Riz et Rizicult.* 1959, **5,** No. 1, 5–11, English and Spanish summaries.

1761 Walter, C. La risicoltura nel Brasile. [**Rice-growing in Brazil.**] *Riso* 1959, **8,** No. 6, 8–10, illus.

1762 Davis, L. L. **Improved rice seed production and distribution in Ceylon.** *Internat. Rice Comm. News Lett.* 1959, **8,** No. 1, 9–19.

A scheme is presented.—E.B.O.

1763 Catambay, A. B. and others. **Effect of continuous submergence of various depths of irrigation water on the growth and yield of lowland rice.** *Philipp. Agriculturist* 1959, **42,** Nos. 8 and 9, 358–63, bibl. 3 in text. [Cent. Exp. Sta., Univ. Philipp., College, Laguna]

Levels of irrigation water 5, 10, 15 and 20 cm. deep were maintained in plots of Tjere Mas rice throughout the growing seasons Aug.–Dec. and Apr.–Aug. The application of 110, 192, 230 and 240 cm. of water was required to maintain these respective water-levels. Yields, plant height and number of tillers were not significantly affected by the different irrigation treatments.—R.B.

1764 Roy, Subodh Kumar. **Second flowering in *Oryza sativa* (var. *indica*).** *Nature, Lond.* 1959, **183,** No. 4673, 1458–9. [Indian Statist. Inst., Calcutta]

In July 1958, three small plots (5·2 sq. m. each) in Bihar were planted with the rapidly maturing rice variety CH-10. Because of the late monsoon, the crop was poor. Instead of drying and cutting as usual, the plots were not allowed to dry, and the ears were plucked by hand on 10 Oct. A second crop was produced, regeneration occurring through the formation of new tillers at the base and new branches at some nodes of the stems of the harvested plants. The new tillers and new branches flowered, and thus produced a second crop, which was harvested on 23 Nov. by the usual method. Yield was increased by 117%, i.e. was more than doubled. The economic value of this method of harvesting rice is being studied.—M.H.

1765 Evatt, N. S. **Stubble rice production tests.** *Rice J.* 1958, **61,** No. 6, 18–9 and 40. [Rice-Pasture Exp. Sta. Beaumont, Texas]

The 8- to 9-month growing season of the Texas Gulf Coast Prairie is not quite long enough to permit two successive rice crops to be grown from seed. A preliminary test in 1956 demonstrated that ratooning was possible if an early-maturing variety was used and the crop was combine-harvested to leave at least 17 in. of stubble. This cutting height was necessary even though all tillering came from the base of the plant. In 1957, more than 4000 lb. grain/ac. were obtained from

the first crop and more than 2000 lb./ac. from the ratoon-crop. Highest yields were obtained by applying N and P to the crop soon after sowing, and again to the ratoon-crop soon after cutting. There was no response to K. The first crop must be harvested before 10 August to obtain a successful ratoon-crop. Varieties which mature even earlier than Century Patna 231 would be an advantage.—J.D.J.

1766 Fu-Min, T. and others. **Survey and discussion on the fertility of rice fields in relation to various rotations and double-cropping systems in Kiangsi Province (Report 1).** [Chinese] *Acta Agric. sinica* 1959, **10,** No. 1, 42–51.

1767 López-Ríoboo, T. F. and others. Ensayos comparativos de variedades de arroz (año agrícola 1955). [**Comparative trials with rice varieties. 1955.**] *An. Inst. nac. Invest. agron.* 1958, **7,** No. 4, 877–960, illus.

The results are given from trials to test 16 rice varieties in various regions of Spain (including regions where rice is an old-established crop and those where it has been introduced recently). The general conclusion was that Sordo, Puebla Larga, Stirpe 136 and Balilla × Benlloch yielded best in most cases ; Rinaldo Bersani, Insen × Tremesino, Maracay and Arborio yielded less than other varieties but their grain was of a superior quality. Some of the other varieties tested, whose average yields were intermediate, were outstanding in some regions : Razza 77 and Balilla Double in Sevilla, Colusa × Nano in Zaragoza and Americano 1600 in Valencia.—E.B.O.

1768 Buffa, G. Prove comparative e saggi di rendimento fra diverse razze di riso. [**Comparative yield trials with rice varieties.**] *Riso* 1959, **8,** No. 2, 6–10, illus.

The results are given from plot trials to compare rice varieties in the provinces of Novara and Vercelli, in 1958. At Novara, Balilla Large Grain yielded best with an average of 8688 kg./ha., followed by Americano 1600, Rizzotto, R.B. and Arborio. At Vercelli, Americano 1600 and Balilla Large Grain gave similar yields (7094 and 7092 kg./ha., respectively) and were followed closely by Lomello and Roverbella, while Stirpe 82 Chiappelli yielded significantly less.—E.B.O.

1769 Piacco, R. Le principali varietà di riso : la Razza 77. [**The principal rice varieties (in Italy) : Razza 77.**] *Riso* 1959, **8,** No. 6, 15–16, illus.

Information is given on the rice variety Razza 77, grown almost exclusively in the province of Vercelli. It is the earliest of the Italian fine varieties, being harvested about 15–20 Sept. It is prone to lodging.—E.B.O.

1770 Arruda, H. V. O arroz Batatais ou de " 3 meses " em São Paulo. [**The rice variety Batatais or " 3 months " in São Paulo (Brazil).**] *Lavour. arroz.* 1959, **13,** No. 146, 16.

Information is given on the rice variety " 3 months " grown in Batatais, which matures 95–110 days after germination.—E.B.O.

1771 Smith, R. J. **Chemical control of barnyard grass in rice.** *Ark. Fm Res.* 1958, **7,** No. 2, 2, illus. [U.S. Dep. Agric. and Ark. Agric. Exp. Sta.]

Efficient control of barnyard grass (*Echinochloa crus-galli*), resulting in twice the yield of rice, was obtained using CIPC at 6 lb./ac. Least injury to the rice occurred when the seed was drilled at a depth of 1 to 1·5 in. Maximum weed control and minimum crop damage occurred when CIPC was applied before the grass had passed the first-leaf stage, irrespective of the stage of growth of the crop. No damage was done by irrigating immediately after spraying, but a precautionary delay of 7–10 days is recommended.—J.D.J.

1772 Ingebretsen, K. and others. **Iron deficiency of rice.** *Calif. Agric.* 1959, **13,** No. 2, 6–8 and 14, illus. [Univ. California]

Failure of rice to grow on alkaline, non-saline areas in 3 counties of California was related to Fe deficiency and could be corrected by applying 500 lb. $Fe_2(SO_4)_3$/ac., or by suitable Fe chelates. On soils which were both alkaline and saline, response to application of $Fe_2(SO_4)_3$ could only be expected where the soluble salt content of the soil had been reduced by leaching.—J.D.J.

1773 Krishnaswamy, N. and Chandrasekharan, P. **A new species of *Oryza*, L.** *Madras agric. J.* 1958, **45,** No. 12, 471–2, bibl. 1. [Res. Inst., Coimbatore]

The botanical description is given of *O. malampuzhaensis* spec. nov., a perennial. It was found along the margins of forest rivers at elevations of 2000 ft. in Madras State and near a reservoir at 500 ft. in Kerala State.—D.B.

1774 Govindaswami, S. and Krishnamurthy, A. **On the occurrence of japonica type of rice grains in Jeypore Tract.** *Rice News Tell.* 1958, **6,** No. 4, 22–3, bibl. 2. [Central Rice Res. Inst., Cuttack, India]

1775 Suzuki, S. and Sado, T. **Physiological and ecological studies on the root-function of lowland rice. 1. Effects of the low temperature during night-time in different stages in growth upon the root-function and the growth and yield of rice plants.** [Japanese] *Sci. Rep. Fac. Agric., Meijo* 1957, No. 2, 33–41, English summary.

A low night-temperature of 20°C. during the

tillering stage retarded growth in plant height and increased oxidation by roots, number of stems, number of grains per panicle and rice yield. Two varieties were studied. There appeared to be varietal differences in [the degree of] the response to this low night-temperature. F. Eng. s.—D.B.

1776 RAM, C. S. V. **Production of growth-promoting substances by Fusaria and their action on root elongation in *Oryza sativa* L.** *Proc. Indian Acad. Sci.*, 1959, **49**, No. 3, 167–82, bibl. 17. [Bot. Lab., Univ. Madras]

The growth-promoting substances present in the culture filtrate of several *Fusarium* spp. were identified as amino acids and vitamins. 5% solutions of the filtrate (in distilled water) caused marked root elongation in 3-day-old rice seedlings. The elongation was caused by cell extension and was not accompanied by a corresponding increase in dry matter. F. s.—D.B.

1777 MURAKAMI, Y. **The effect of the extract of immature bean seeds on the growth of coleoptile and leaf of rice plant.** *Bot. Mag. Tokyo* 1957, **70**, 833–4, 376–82, bibl. 9. [Nat. Inst. Agric. Sci., Nishigahara, Tokyo, Japan]

1778 GO BAN HONG and SCHUYLENBORGH, J. VAN. **Leaf composition of lowland rice and sugar cane as an indicator of their performance.** *Neth. J. agric. Sci.* 1959, **7**, No. 2, 110–7, bibl. 14. [Univ. Indonesia, Bogor]

The ratios between N, P and K in leaves of lowland rice, var. Tjina, grown in pot experiments, remained relatively constant throughout the growing season. There was a close relationship between mineral composition of leaves and yields of grain and straw. It was considered that foliar analysis of rice plants at 30 days after transplanting would give a reliable indication of the nutritional status at a stage when additional fertilizer could still be utilized. In rice, P appeared to be the most, and K the least, readily translocated of the major elements.—R.B.

1779 TANAKA, S. and TOKUOKA, M. **Influence of sulphur upon the metabolism of plant. 1. Deficiency of sulphur on rice plant and its recuperation.** [Japanese] *Sci. Rep. Fac. Agric. Meijo* 1957, No. 1, 31–40, bibl. 20, English summary.

1780 MORITA, S. **Nutrient absorption by rice from media containing different types of clay minerals.** *Soil Sci.* 1958, **86**, No. 6, 336–42, bibl. 15. [Saikyo Univ., Kyoto, Japan]

1781 SHU-VENG, Y. and others. **Comparative studies on the physiology of lowland and upland rice. 1. On the water relation and drought resistance of lowland rice "Lao Lai Ching" and upland rice "Nang Ton Xao".** [Chinese] *Acta bot. sinica* 1958, **7**, No. 4, 187–202, bibl. 33, illus., English summary. [Inst. Pl. Physiol., Academia Sinica]

1782 NJOKU, E. **Response of rice to small differences in length of day.** *Nature, Lond.* 1959, **183**, No. 4675, 1598–9, bibl. 4. [Bot. Dep., Univ. Coll., Ibadan, Nigeria]

The author obtained responses to small differences in photoperiod with West African upland cultivated rices (varieties of *Oryza sativa* and *O. glaberrima*) similar to that reported by Dore for a Malayan rice [Abs. 1243].—M.H.

1783 SADO, T. **Effects of the diurnal range of maximum and minimum temperatures on the growth and ripening of paddy rice plant. 1. Effects of the night temperature range on the paddy rice plant during ripening stage.** [Japanese] *Sci. Rep. Fac. Agric. Meijo* 1957, No. 1, 17–22, bibl. 7, illus., English summary.

1784 PONNAMPERUMA, F. N. **Fertilizer trials in cultivators' fields in Ceylon.** *Internat. Rice Comm. News Lett.* 1959, **8**, No. 1, 1–8. [Div. Chem., Dep. Agric., Peradeniya, Ceylon]

On moderately well-drained acid lateritic soils, the response of rice to N was linear in the range 0–60 lb. N/ac. and averaged 9 lb. grain per lb. of N applied. Top dressing certain fields with 100 lb. ammonium sulphate increased grain yields by almost 12 bu./ac. or 25%. In NPK manurial trials with rice, the best combination in various districts was 60 lb. N plus 40 lb. P_2O_5 per ac.; K dressing had no effect. F. s.—E.B.O.

1785 KOCZOR, F. and PRETTENHOFFER, I. A talajjavítás, mütrágyázás es talajtípus hatása a rizs szemtermése minöségi tulajdonságainak alakulására. **Effect of soil amelioration, fertilization and soil type on the qualitative properties of rice grains.** *Növenytermelés* 1959, **8**, No. 1, 1–14, bibl. 7, Russian and English summaries. [Res. Inst. Irrig. and Rice Prod., Szarvas, Hungary]

1786 DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA. [**Rice.**] *Rep. Dep. Agric. Malaya 1956*, 1958, 8–9, 36–9 and 97–8, illus.

1. Although the total acreage under swamp and upland rice in 1955–6 (876,000 ac.) was lower than in the previous season (891,000 ac.) and the weather was unfavourable, production increased by 15,100 tons. Estimates for 1956–7 show an increase of 11,000 ac. in the rice area.

2. Seed germination trials. The highest germination percentage was obtained in the absence of fertilizer and in running water. In a study of the effect of different N fertilizers in wet nurseries, the

most uniform germination was obtained by using calcium cyanamide, whilst the highest fresh weight of seedlings was produced by using ammonium sulphate which, however, reduced germination percentages. Treatment of seed with a mercurial fungicide before storage had no deleterious effect on the germination of seed stored for a year. Towards the end of that period, treatment immediately before sowing increased germination percentage over that of the untreated controls, an effect which was not found where the seed was treated before storage.

3. A trial in tanks at Kuala Lumpur, showed that swamp rice could be grown successfully on peat, the principal requirement being N, the application of which almost doubled yields.

4. In a trial in tanks at Kuala Lumpur, the effect on growth and yield of the main crop, of the following off-season treatments is being investigated : (a) soil kept wet ; (b) wet soil plus off-season rice ; (c) soil kept dry ; and (d) dry soil with an off-season tobacco crop. The tanks kept wet produced a weed flora consisting mainly of *Monochoria vaginalis* and a small *Cyperus* sp. while the dry tanks grew tall *Fimbristylis miliacea* and *Cyperus digitatus*. In the tanks with off-season paddy, the weeds were eliminated through competition with the paddy. The effects of these treatments on number of tillers and plant height of the main rice crop are tabulated.

5. Varieties. On several farms in Malacca. Nachin 5057 yielded more than 700 gantangs [1 gantang = 1 gal.] per ac. Other varieties grown for distribution were Reyong 6, Siam 29, Serendah Kuning 3 and Radin Siak 34. In 3 seed-farms in Negri Sembilan the varieties sown were Serendah Kuning 3, 11 and 23, and Acheh Puteh (early).—E.B.O.

1787 Manni, M. and Hogan, T. T. **The first pilot rice mill in Liberia.** *Internat. Rice Comm. News Lett.* 1959, **8**, No. 1, 26–30, bibl. 2, illus. [FAO, Rome]

ZIZANIA AQUATICA

1788† Kristkalne, S. H. [**Water rice (*Zizania aquatica* L.) in Latvian SSR.**] [Russian] *Bot. Ž., SSSR (Bot. J., USSR)* 1959, **44**, No. 2, 209–11, bibl. 8. [Biol. Inst., Acad. Sci. Latvian SSR]

Information is given on the occurrence of this annual grass in the USA (where the seed has long been used as a food by the Red Indians), in the Latvian Republic and regions of north-west USSR. The plant is grown mainly for waterfowl, especially duck. At the flowering stage, total protein content (in % absolute dry matter) is approx. : stem, 7 ; seed, 11 ; leaves, 12.—M.H.

CEREALS — GENERAL

1789† Morris, H. D. and Gardner, F. P. **The effect of nitrogen fertilization and duration of clipping period on forage and grain yields of oats, wheat and rye.** *Agron. J.* 1958, **50**, No. 8, 454–7, bibl. 12. [Univ. Georgia Coll. Exp. Sta., Athens]

Arlington oats, Chancellor wheat and Wren's Abruzzi rye were used to study the possibility of obtaining a high yield of both forage and grain. Two levels of N (60 and 120 lb./ac.) were combined with the following winter treatments ; clipping until (a) 15 January, (b) 15 February, (c) 15 March, and (d) control (not clipped). Treatment (c) reduced grain yield by 75% or more because of removal of primordia, but (b) decreased it only slightly in wheat and oats and produced a slight increase in rye, because of delayed maturity and less frost damage. The higher rate of N treatment increased the mean grain yields of all crops receiving treatment (a) and the yield of oats and rye receiving treatment (b). Forage yields were highest in rye and lowest in wheat ; they increased in all crops with later cutting dates and with the higher levels of N. Treatments (a), (b) and (c) resulted in respective mean forage yields for all cereals of 300, 550 and 2100 lb. oven-dry forage/ac.; the higher rate of N application increased respective mean forage yields by approx. 100, 250 and 750 lb./ac., compared with the lower rate of N application.—J.E.T.

1790 Pohjanheimo, O. Lämpö- ja sadeolojen vaikutuksesta kevätviljoihin jokioisissa 1930–54. [**Effect of temperature and precipitation on summer cereals in Jokioinen during 1930-54.**] *Maatal. ja Koetoim.* 1959, **13**, 87–97, illus., Germany summary.

In varietal trials at the Jokioinen Research Centre (60°N., 23°E.) in S.W. Finland, Diamant spring wheat, Binder barley and Golden Rain II oat were grown on stiff clay during 25 years. There is evidence that the average temperature during the vegetative period was not the most important factor determining yields of these varieties. Lack of precipitation in June had the greatest adverse influence on yields. F. Ger. s.—M.H.

1791 Hill, M. J. and Moffatt, J. R. **Summary of cereal variety trials at Rothamsted and Woburn, 1955-58.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 180–4.

Spring wheats. Koga II usually outyielded all other varieties tested. Svenno responded to N more than the other varieties did. Atle was outyielded by all the other varieties, except for Svenno at the low level of N. Winter wheats. Capelle consistently outyielded all other varieties tested, except for Leda in 1957. Barley. The standard varieties Herta and Proctor were not outyielded in any of the tests.—A.M.H.

1792 Middleton, G. K. and others. **Small grain varieties for North Carolina.** *Bull. 408 N.C. Agric. Exp. Sta.* 1958, pp. 16, illus.

Varietal recommendations for barley, oats, rye and wheat are given.—R.B.

1793 Oltmann, W. Der Keimrollentest und seine Anwendungen für die praktische Samenprüfung bei Getreide und für zytologische Untersuchungen. [**The paper-roll germination-test and its application for the testing of cereal seeds and for cytological examinations.**] *Saatgut-Wirtsch.* 1959, **11**, No. 5, 143–5, bibl. 3, illus.

The article is concerned with the advantages of this method compared with the tetrazolium method and with germination in sand. The advantages include technical simplicity, reproducibility and the possibility of making observations on the roots as well as on shoots.—D.B.

1794 Hewett, P. D. **The behaviour of mercury/BHC-dressed cereal seed in germination tests.** *J. Inst. corn agric. Merch.*, 1959, **7**, No. 2, 88–9, bibl. 4.

Considerable confusion can be caused during germination tests on cereal seed by prior application of organo-mercurial/BHC dressings. Points at which confusion can arise are described, including the interactions of mergamma D with dormancy and with the standard dormancy treatments. F. s. —C.L.S.

1795 Füredi, J. Öszi kalászosaink generatív szerveinek képződése az egyedfejlödés során. **Ontogenetic development of the generative organs in winter cereals.** *Növénetermelés*, 1959, **8**, No. 1, 45–60, bibl. 19, illus., Russian and English summaries. [Univ. Agric. Sci. Gödöllö, Hungary]

1796 Stroun, M. and Pugnat, C. Relations entre l'accomplissement du photostade et la résistance au froid des céréales. [**Relationship between the completion of the photophase and the resistance to cold in cereals.**] *Phyton* 1958, **11**, No. 1, 1–14, bibl. 32, illus. [Inst. Bot. Univ. Genève, Switzerland]

The results from this study showed that the resistance of cereal varieties to cold can be determined from their photoperiodic behaviour, without subjecting the plants to low temperatures. It was found that the greater the photoperiodical requirements of a variety, the greater its resistance to cold. Autumn cereal varieties and interchangeable varieties which require more favourable conditions of light to complete their photophase, are less susceptible to frost than spring varieties. It would, therefore, appear that the so-called " resistance to cold " character does not exist as such, but is the result of different physiological phenomena, among which the photoperiodic ones are of primary importance. A " photophasic key " is presented for determining the resistance to cold of a variety and is based on the following factors : interval of time required for completion of the photophase under continuous light ; critical duration of light below which development is distinctly retarded ; and ratio between the time required to complete the photophase under long-day and that required under short-day conditions.—E.B.O.

1797 Skazkin, F. D. [**The effect of deficient and superfluous moisture in soil on certain physiological processes and yields of spring-sown cereal crops.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 205–19, bibl. 50. [Leningrad State Pedagogic Inst.] [Received Aug., 1958]

See also Abs. 877.

1798† Pearson, G. A. and Bernstein, L. **Influence of exchangeable sodium on yield and chemical composition of plants. 2. Wheat, barley, oats, rice, tall fescue and tall wheatgrass.** *Soil Sci.* 1958, **86**, No. 5, 254–61, bibl. 14. [Agric. Res. Serv., U.S. Dep. Agric., Riverside, California]

The relative tolerance of 4 grain and 2 grass crops to increasing levels of exchangeable Na was studied on 2 soils of contrasting exchange capacities. Yield was related to exchangeable Na percentages (ESP), rather than to the absolute amount of exchangeable Na present. The relative tolerance of the crops studied was : tall wheatgrass (*Agropyron elongatum*) > barley > wheat > rice > tall fescue (*Festuca elatior* var. *arundinacea*) > oats. Increasing Na and decreasing Ca and K concentrations in the plants were associated with increasing ESP values. Changes in yield and ionic composition were related to increasing ESP values, but the relative tolerance of the crops studied was not consistently related to mineral nutrition. F. s.—E.B.O.

1799 Widdowson, F. V. and Penny, A. **Field experiments on nitrogen fertilizers. Cereals.** *Rep. Rothamsted Exp. Sta., 1958*, Harpenden, 1959, 45–6.

Capelle wheat sown in Oct. 1957 received seed-bed dressings of ammonium sulphate (0·6 or 1·2 cwt. N/ac.), or equivalent top dressings in mid-March or mid-May. Divided dressings applied at 2, or all 3, of the dates of manuring were compared with single dressings. At 3 centres March dressings produced the highest average increase in yield and May dressings the lowest. Divided dressings gave lower yields than single ones applied in March. At 3 other centres, lodging decreased average yields, but May dressings gave the highest mean increase. Work on combine-drilling N for barley [see *Fld Crop Abstr.* 11 : 1437] was continued. In 1957 the barley was sown on badly prepared seed-beds and

a spell of dry weather followed. Drilling ammonium sulphate at 0·9 cwt. N/ac. delayed emergence by 7–10 days, 0·6 cwt. N/ac. gave a slight check and 0·3 cwt. N/ac. was not harmful. Drilling gave higher yields than broadcasting at low and medium levels of N, but was inferior to broadcasting at the highest N level. In the moister and better prepared seed-beds used in 1958, there was no check to growth and drilling ammonium sulphate gave higher yields than broadcasting at all N levels.—A.M.H.

1800 Valmari, A. Väkilannoituksen vaikutuksesta ohran, kauran ja perunan hallankestävyyteen. **The effect of manuring on the frost resistance of barley, oats and potatoes.** *Maatal. ja Koetoim.* **13,** 54–63, English summary. [Frost Res. Sta., Pelsonsuo, Finland]

During 1952–7, observations were made on the effect of different NPK treatments on the frost resistance of oats and barley grown on peat soil. In 1952 and 1956, early frosts caused heavy damage to the grain, reducing the germination of barley to 1 – 10%, and that of oats to 40% in 1952 (in 1956 the frosts prevented the oats from ripening). N manuring increased the yields more in frost years than in normal years, possibly because the frost years were generally cool and thus the mineralization of peat N was reduced. These results do not conform with the general opinion that low N supplies tend to lessen the damage caused by early frosts. P manuring resulted in no significant difference between the crops grown in frost years and in normal years. The effect of K was similar to that of N, although less distinct. The germination capacity of the barley harvested in the frost year 1956 was not affected by N or by P and was only slightly improved by K. In potato trials in 1958, applications of N and K reduced frost damage. The beneficial effect of N may be due partly to the more vigorous growth of the treated plants and the consequent change in the microclimate. Any attempt to reduce frost damage by using manurial treatments which differ from those found most profitable in normal years is not recommended. F. Eng. s.—M.H.

1801 De Cillis, U. Sviluppo e fattori di progresso della cerealicoltura. [**Development and factors influencing the progress of cereal-growing.**] *Rep. Wld Congr. agric. Res., Rome* 7–9 May, 1959, pp. 30, English, French, German and Spanish summaries.

Information is given on areas and production of cereals in the world.—E.B.O.

1802 Sandison, A. and Bartlett, B. O. **Comparison of varieties for yield.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 351–7, bibl. 4.

Evidence from NIAB trials suggests that between-trials error is greater than within-trials error. The size of the between-trials error when varietal results are expressed as percentages of a control was estimated from the standard errors of variety means, from the percentage differences between pairs of varieties and the probability that one will outyield the other, and from analyses of variance. Results obtained by the 3 methods agreed sufficiently to justify the assumption that the between-trials error is relatively constant for a given crop. The between-trials error of cereal trials in England and Wales appears to be of the order of 10% and depends on the varieties concerned. It is concluded that about 20 trials are necessary for a 5% difference from the control to be significant at P = 0·05 and about 30 trials for a 4% difference to be significant.—A.M.H.

LEGUMES

SOYABEANS

See also Abs. 1822, 1938, 1947, 1953, 1960, 2057.

1803 Wu, W. and Hsing, C. Y. **The effect of seed treatment with microelements upon the growth, yield and quality of soybean.** [*Chinese*] *Acta Agric. sinica* 1958, **9,** No. 4, 333–9, bibl. 12, English summary. [Dairen Med. Coll., China]

Soyabean seeds, previously soaked in solutions containing compounds of microelements, were grown in pots, field plots and on farms. In this descending order, Zn, Mn and B gave greater increases in seed yield than did other microelements. B increased the protein content and Zn the oil content of the seed. F. Eng. s.—D.B.

1804 McAlister, D. F. and Krober, O. A. **Response of soybeans to leaf and pod removal.** *Agron. J.* 1958, **50,** No. 11, 674–7, bibl. 9, illus. [U.S. Regional Soybean Lab., Urbana, Ill.]

When up to 22% of the pods of Lincoln soyabeans, or up to 17% of the pods of Hawkeye soyabeans, were removed, compensating increases in seed weight occurred and yields were close to the maximum. Sugars, starch and protein accumulated in the leaves and stems of plants which had 80% of pods removed ; no consistent differences in chemical composition were observed between the controls and less severe pod-removal treatments. Pod removal increased the seed protein content and decreased the oil content and its iodine number. Seed yields of plants with 80% artificial defoliation were reduced by nearly 50%, and yields of plants with 40% defoliation by 21%. Severe defoliation (80%) decreased the protein content and raised the oil iodine number of the seed. F. s.—R.B.

1805 Nanda, K. K. and Hamner, K. C. **Studies on the nature of the endogenous**

rhythm affecting photoperiodic response of Biloxi soybean. *Bot. Gaz.* 1958, **120**, No. 1, 14–25, bibl. 15. [Univ. California, Los Angeles]

Potted Biloxi soyabean plants each with 3 trifoliate leaves were subjected to 7 photoperiodic cycles varying in length from 24 to 96 hr. The photoperiods given were 8, 16 or 32 hr. at 12°C., or 8 hr. at 27°C., and the temperature during the dark periods was 27°C. The plants were then transferred to long-day conditions for 35 days. Where 8 hr. light at 27°C. was given, maximum floral initiation occurred at cycle lengths of 24, 48 and 72 hr., and minimum flowering with 36- and 60-hr. cycles. Floral initiation was greatly depressed where 8 hr. light at 12°C. was given. With 16-hr. photoperiods and low temperature, maximum floral initiations was delayed 12 hr. and occurred during 36- and 60-hr. cycles. With 32-hr. photoperiods at 12°C., maximum floral initiation occurred with 72-hr. but not with 48-hr. cycles. Plants grown with 8-hr. photoperiods at 27°C. showed a considerable alteration in the floral rhythm where the dark period was broken by 30 min. light at its mid-point or 16 hr. after its beginning ; the flowering response obtained with this treatment appeared to depend on the length of the interval between the light interruption and the beginning of the next photoperiod. [See *Fld Crop Abstr.* 11 : 605.]—R.B.

1806 Biebl, R. Radiomorphosen an *Soja hispida.* [**Morphology of *Soja hispida* following radiation.**] *Flora, Jena* 1958, **146**, No. 1/2, 68–93, bibl. 40 approx., illus. [Pflanzenphysiol. Inst., Univ. Wien, Austria]

Seeds and seedlings of *Glycine max* were treated with 250, 500, 1500, 2000 and 3000r., then allowed to continue growth in the open. The resulting morphological and anatomical deformations in the leaves are described. Flowering was reduced. The influence of X-ray treatment on growth substances is discussed.—D.B.

1807 Brim, C. A. and Mason, D. D. **Estimates of optimum plot size for soybean yield trials.** *Agron. J.* 1959, **51**, No. 6, 331–4, bibl. 5. [N. Carolina Agric. Exp. Sta., Raleigh]

GROUNDNUTS

See also Abs. 2057, 2064.

1808 Dalal, J. L. and Negi, L. S. **Groundnut as a rotation crop under irrigated conditions in the Punjab.** *Indian Oilseeds J.* 1958, **2**, No. 4, 69–74, bibl. 4.

The object was to study the soil-enriching properties of the groundnut plant. Grain yields of wheat (winter crop) were higher after groundnut (monsoon crop) grown alone or with cotton or maize than after cotton or maize separately. The groundnut/wheat rotation gave the highest net income. The experiments proved the possibility of growing groundnut in a rotation on light loam soils under irrigation.—D.B.

1809 Singh, M. P. and Amarnath, L. **Introduction of improved strains of castor and groundnut in Bihar.** *Indian Oilseeds J.* 1959, **3**, No. 1, 14–18.

From the results of 14 replicated and randomized trials with 18 varieties of groundnut, the following varieties were recommended for multiplication : Big Japan for the clay-loam soils of Sabour (S. Bihar), and TMV.1 for the red lateritic soils of Dumka and the gangetic alluvium of N. Bihar at Purnea.—D.B.

1810 Inoue, Y. **Studies on the flowering habit in peanut.** [Japanese] *J. hort. Assoc. Japan* 1958, **27**, No. 4, 245–8, bibl. 4, English summary.

The sequence of flower initiation at the nodes of the main stem and branches, graduations in the number of flowers per node, and the length of the flowering period were studied in Java, an early variety of groundnut. F. Eng. s.—D.B.

1811 Bolhuis, G. G. **Observations on the flowering and fructification of the groundnut, *Arachis hypogaea*. 4.** *Neth. J. agric. Sci.* 1959, **7**, No. 2, 138–40, bibl. 2. [Lab. Trop. Agric., Wageningen, Netherlands]

1812 Mills, W. T. and Dickens, J. W. **Harvesting and curing the windrow way.** *Bull. 405 N. Carolina Agric. Exp. Sta.* 1958, pp. 20, illus.

A method for harvesting groundnuts from windrows is described. Combine-harvesting of the windrows should be begun when the moisture content of the groundnuts is about 25%. After combining, drying with heated air at less than 95°F. at a rate of 5 cfm. per cu. ft. of groundnuts is recommended. Groundnuts should be dried to moisture content between 7 and 12%.—R.B.

PEAS

See also Abs. 1947, 1949, 1951, 1952, 2014.

1813 Kooistra, E. and Kooten, A. v. Kort verslag " voorselectie " – proef doperwtenrassen IVT – 1958. [**Short report on green pea pre-selection trial IVT, 1958.**] *Tech. Ber. Peulvrucht.* 1959, No. 79, 42–7, bibl. in text.

The results are given of preliminary screening trials with 60 green pea varieties, including round- and wrinkled-seeded types.—G.M.R.

1814 Riepma Wzn, P. and Veenbaas, A. Resultaten van de doperwtenrassenproef PAW 121, 1958. [**Results of the PAW green pea varietal trial No. 121, 1958.**] *Tech. Ber. Peulvrucht.* 1959, No. 79, 1–41.

Eleven round-seeded and 16 wrinkled-seeded varieties, including 2 from Gt Britain, were compared. Tabulated information is given on their agricultural qualities (disease resistance, vine length, resistance to lodging, yield), and their eating qualities for consumption when fresh, canned and deep frozen.—G.M.R.

1815 Clark, B. E. and Baldauf, Dorothy. **A cold test for pea seeds.** *Proc. Ass. off. Seed Anal. N. Amer.* 1958, **48**, 133–5. [New York State Agric. Exp. Sta., Geneva, New York]

Germination tests made after chilling pea seed for 7 days at 4–6°C. gave a better indication, in 2 years out of 3, of germinating capacity in the field than did the standard test, and appeared to be more reliable when conditions were unfavourable. The cold test is recommended as a supplement to, and not as a substitute for, the standard test.—J.D.J.

BEANS

See also Abs. 1822, 1938, 1958, 1968, 1988, 2014, 2058, 2062, 2064.

1816 Way, M. J. and Doherty, T. **Bean aphid (*Aphis fabae* Scop.) control.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 127.

Spring beans were sown on 18 March, 1958, in rows 22 in. apart at plant densities from 5·3 to 106 plants/yd. of row, and were unsprayed, or sprayed with 6 fl.oz. demeton methyl/ac. Initial infestation and subsequent build-up of aphid population, both per plant and per unit-area, was greatest where the plant stand was thin. Yield increases from spraying were negligible at 106 and 57 plants/yd. of row, increasing to 7·5 cwt./ac. at 5·3 plants/yd.—A.M.H.

1817 Ramshorn, K. Zur partiellen "aeroben" Gärung in der Wurzel von *Vicia faba*. 2. [**Partial fermentation by aerobic bacteria in the roots of *Vicia faba*. 2.**] *Flora, Jena* 1958, **146**, No. 1/2, 178–211, bibl. 2. [Inst. Kulturpflanzen Forsch. der Dtsch. Akad. Wiss., Berlin]

1818 Resch, A. Weitere Untersuchungen über das Pfloem von *Vicia faba*. [**Further experiments on the phloem of *Vicia faba*.**] *Planta* 1958, **52**, No. 2, 121–43, bibl., illus. [Univ. Freiburg i. Br., W. Germany]

LUPINS

See also Abs. 1822, 1968, 1997.

1819† Instituut voor Bodemvruchtbaarheid, Netherlands. Verbouw van lupinen op heideontginningen. [**Lupin-growing on reclaimed peat lands.**] *Landb Voorl.* 1958, **15**, No. 12, 657.

Investigations are being made by the Institute of Soil Fertility into repeated cases of failure to grow lupins on newly reclaimed peat lands in the Netherlands. Field and laboratory trials showed that peat soil contains a hitherto undefined substance which inhibits the formation of root nodules on lupins. It is water-soluble and is eventually leached by rain. In the Netherlands the period February to May is the driest of the year and most of the cases of lupin failure are traceable to sowing in the spring after breaking up peat land the previous winter. It is advisable to leave the land fallow for 1 year before sowing lupins and to inoculate the seed. If, however, it is desired to sow immediately after breaking up the land, N should be applied at the rate of 40 kg./ha.—G.M.R.

1820† van Steveninck, R. F. M. **Abscission-accelerators in lupins (*Lupinus luteus* L.).** *Nature, Lond.* 1959, **183**, No. 4670, 1246–8, bibl. 10. [DSIR, Christchurch, N.Z.]

See also *Fld Crop Abstr.* 11 : 1099.—M.H.

VETCH

1821† Novožilov, I. I. [**Sowing spring vetch with mustard, *Sinapis alba*.**] [Russian] *Zemledelie (Agriculture, USSR)* 1959, **7**, No. 4, 76. [All-Union Sci. Res. Inst. of Fodders]

Seed production of spring vetch in the non-chernozem belt is complicated not only by slow ripening of the crop (in some years) but also by excessive lodging. When grown for seed, vetch is usually sown under oats ; it is claimed that 3 or 4 oat plants are required to support one vetch plant and that approx. 50–70 kg. vetch seed should be sown under 135–140 kg. oats per ha. In dry summers, however, the vetch yield is lowered where these rates of sowing are used, owing to competition of the oats for moisture. During 1955–8, trials were made with sowings of *Sinapis alba* as a substitute for oats under vetch ; the mustard has stronger stems than oats, and it ceases growth when vetch is in full flower. The vetch thus receives full illumination and its seed ripens 4 or 5 days earlier than with oats ; harvesting by combine is possible. The best sowing rate is 100 kg. vetch with 9–12 kg. mustard, or 70 kg. vetch with 6 kg. mustard per ha. With the latter rate a vetch-seed yield of 1520 kg./ha. has been obtained. A seed drill can be used to sow both crops, a herbage seed drill being suitable for the mustard seed which should be sown at a depth of 0·5–1·0 cm. The mustard should not be sown from the same drill as the vetch as this places the mustard too deep and it fails to germinate. The mustard requires a higher soil fertility than either vetch or oats.—M.H.

LEGUMES—GENERAL

1822† Vidal, A. A. Determinación de lecitina y cefalina en semillas de leguminosas. [**De-**

termination of lecithin and cephalin in legume seeds.] *Rev. Fac. Agron., La Plata* 1958, **34,** No. 1, 81–90, bibl. 14, English conclusions.

Determinations were made of the lecithin and cephalin content in the seeds of the following species, amongst others : *Vigna sinensis*, *Lupinus albus*, *Vicia faba* var. *major*, *V. villosa*, *V. sativa* and *Glycine max*. Lecithin was present in higher amounts than cephalin, the ratio of lecithin to cephalin varying from 7 : 3 to 8 : 2. There was no close relationship between the amounts of these phosphatides and that of crude protein.—E.B.O.

ROOT CROPS

SUGAR-BEET

See also Abs. 1968, 2048, 2057, 2058.

1823 Shepherd, R. W. and Harvey, P. N. **Vigour of germination of rubbed and graded sugar beet seed.** *Exp. Husb.* 1959, No. 4, 1–6, bibl. 2. [Norfolk Agric. Sta., Sprowston, England]

Trials were carried out during 1952, '53 and '54 to compare the vigour of growth throughout the season of sugar-beet plants grown from untreated seed-clusters (natural seed) and from different grades [size] of seed from which a proportion of the husk had been removed by mechanical treatment (rubbed seed). Rubbed seed graded between 7/64 and 11/64 in. produced 20% more single plants and had 5–10% lower germination than the untreated seed clusters from which it was derived. Germination of the smaller grade of rubbed seed (7/64 – 9/64 in.) averaged no more than 40%, but 80% of the viable clusters produced only one seedling. Yields of roots at harvest showed no real difference between the crops produced from the different types of seed. The results suggest that plants grown from the standard, commercial, rubbed seed graded between 7/64 and 11/64 in. are as vigorous as those from untreated natural seed. Owing to unreliable germination, the more severely processed seed with clusters not exceeding 9/64 in. cannot be recommended for general use. F. s.—D.B.

1824 Eckroth, E. G. and Cormany, C. E. **Sugar-beet stand studies.** *J. Amer. Soc. Sug. Beet Technol.* 1957, **9,** No. 7, 583–5, bibl. 2.

Investigations on 60 farms in Montana over a 3-yr. period, together with evidence from experimental plots, emphasized the importance of correct thinning of sugar-beet. A stand of 100 beet per 100 ft. of row resulted in the best yields ; more stringent thinning reduced yield. Sucrose percentages in the beets were not affected by stand differences.—D.A.L.

1825 Larson, W. E. **Irrigation of sugar beets.** *Circ. 205 Montana Agric. Exp. Sta.* 1954, pp. 12, illus. [Huntley Branch Sta.] [Received June, 1958]

In 1953, 3 moisture levels in the clay soil in which sugar-beet were growing were maintained by irrigating when 43%, 75% and 95% of the available water had been removed from the root zone. This resulted in 8, 5 and 1 irrigations for the 3 treatments. Total water use, including loss by evaporation and transpiration, was 23% higher with 8 irrigations than with 1, and irrigation requirements were greatest (1·5 in. per week) in late July and August. Irrigation requirements depended on the depth reached by roots, ranging from 2 in. of water for roots 1 ft. deep on 1 July to 6 in. for roots 3 ft. deep 1 month later. Once the roots reached the moist zone above the water table the plants showed no symptoms of drought, even without irrigation. Yields were 23·4, 22·0 and 16·9 tons per ac. with 8, 5 and 1 irrigations. Growth was reduced at available soil-moisture contents of less than about 30%. Experiments with radioactive-P absorption showed that neither the shape of root nor the extent or activity of the root system were dependent on the soil-moisture content.—V.C.F.

1826 Willey, L. A. **Sugar beet trials, 1951-57.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 358–63, bibl. 7.

Twenty-three British and foreign sugar-beet varieties were compared with Sharpe's Klein E. Data presented include % bolting, yields of roots, sugar and tops, sugar content, noxious-N content and juice purity. Sharpe's Klein E was first or second of the British commercial varieties for yield of sugar, and for bolting resistance in 5 of the 7 years. Battles N and N2, Bush N and probably Johnson's N could be expected to give a similar performance to Sharpe's Klein E when grown commercially. The continental varieties commonly showed poor resistance to bolting when grown under British conditions.—A.M.H.

1827 Miranda, O. J. and others. Ensayos comparativos de variedades de remolacha azucarera (año agrícola 1955). [**Comparative trials with sugar-beet varieties. 1955.**] *An. Inst. nac. Invest. agron.* 1958, **7,** No. 4, 961–1057.

The results are given from 12 plot trials to test sugar-beet varieties, grown mostly under irrigation, in different regions of Spain.—E.B.O.

1828 Margara, J. and Touvin, H. La polyploïdie chez la betterave sucrière. [**Polyploidy in sugar-beet.**] *C.R. Acad. Agric. Fr.* 1958, **44,** No. 4, 172–6, bibl. 3. [Sta. Génét. Versailles, France]

In a trial carried out in 1953–6, the polyploid sugar-beet varieties Klein Wanzleben, Hilleshög and Maribo yielded more roots and sugar than

their corresponding diploid types. The respective average yields for the 4 years for the 3 varieties were: root weight (g.), 771, 730 and 745 for the polyploids, and 710, 723 and 730 for the corresponding diploids ; sugar (g. per root), 122, 113·3 and 120·4 for the polyploids and 114·5, 111·7 and 117·6 for the diploids.—E.B.O.

1829 FLAMINI, B. and ANTONIANI, C. Ricerche sulla concia dei glomeruli di barbabietola. [**Investigations on dressing sugar-beet seed-clusters.**] *Progresso agric.* 1959, **5**, No. 1, 58–67, illus. [Ist. Agron., Univ. Bologna, Italy]

Germination tests and field trials were carried out, for one year only on one soil type, to study the advantage from disinfecting sugar-beet seed to prevent foot-rot (*Phoma betae*). Dressing the seed had a beneficial effect consisting mainly in the production of a more uniform stand. Mergamma dust, containing 1% organo-mercury preparation plus 20% γ isomer (lindane), was more effective than caffaro dust based on copper oxychloride (16% Cu).—E.B.O.

1830 DUNNING, R. A. and others. **Seed treatment [of sugar-beet].** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 194–6. [Dunholme Field Sta.]

Seed was steeped for 20 min. in 40 ppm. ethyl mercury phosphate, dusted with γ-BHC, dieldrin or aldrin at 0·67% w/w and with commercial combined organo-Hg/insecticide dusts. EMP-steeped seed gave, on average, 39% more seedlings than untreated seed and 7% more plants in the final stand. The corresponding increases over seed treated with organo-Hg dusts were 11·0 and 2·5%, respectively. EMP + dieldrin gave the same increase in seedling numbers as EMP alone. EMP + γ-BHC and EMP + aldrin depressed seedling numbers by 3 and 6%, respectively, compared with EMP alone. Neither aldrin nor γ-BHC affected the final plant stand, but dieldrin gave a 3% increase. Satisfactory emergence of seedlings was obtained in the field from seed steeped in 10 ppm. EMP solution. Emergence fell off from seed treated with 80–160 ppm. EMP ; with over 240 ppm. it was less than in the untreated control. Batches of seed giving poor germination in laboratory tests responded more to EMP treatment than did seed of good germination. In a batch heavily infested with *Phoma betae*, small seed responded more than large.—A.M.H.

1831† VARIS, A. L. Juurikaskärpäsen torjunnasta. **Control of the mangold fly (*Pegomyia hyoscyami betae*).** *Maatal. ja Koetoim.* 1959, **13**, 64–71, illus., English summary. [Agric. Res. Cent., Tikkurila, Finland]

In 1930, sodium fluoride spray was used to control mangold fly on sugar-beet. Satisfactory results were obtained, but the difficulty of selecting the exact date of treatment made this method impracticable. In 1956 field trials were made at Hyvinkää and at Tikkurila (both in S. Finland) using parathion, endrin, and dipterex to control mangold-fly larvae mining in the leaves of sugar-beets. On 30 June 1st-generation larvae were sprayed with 200 l./ha., when the sugar-beet seedlings were in the 6-leaf stage and the number of eggs averaged 33 per plant, of which 44% were unhatched. All three preparations were equally effective, and increased root yields by about 20% and sugar yields by 20–25%. In a second trial, all three preparations were effective and killed up to 100% of the larvae. Dipterex and parathion were more effective against the eggs than was endrin. Parathion dust was practically ineffective at 10 kg./ha., but gave good control at 20–25 kg. F. Eng. s.—M.H.

1832 DUNNING, R. A. **Insecticides [for control of vectors of sugar-beet yellows].** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 193–4. [Dunholme Field Sta.]

Insecticides were applied on 20 June in 60 gal. water/ac. The amount of active insecticide/ac. and the corresponding % of plants with yellows in Sept. were 15 oz. DDT, 22% ; 6 oz. ekatin M, 30% ; 8 oz. megatox (fluoracetamide), 16% ; 6 oz. metasystox, 13% ; 2 oz. phosdrin, 16% ; 5·1 oz. rogor, 18% ; unsprayed, 32%. The systemic insecticides disyston, thimet and rogor were tested as seed dressings on rubbed and natural sugar-beet seed, at rates averaging 0·625, 2·5 and 0·78% active ingredient, respectively. The dressings caused cotyledon-tip scorch, but had negligible effects on final plant stand. Thimet and disyston used as seed dressings, or drilled with the seed at 0·25–1·0 lb./ac. and 0·5–2·0 lb./ac., respectively, gave complete control of *Pegomyia betae* larvae mining in the leaves up to 7 weeks after sowing. Broadcast soil treatments with these insecticides halved the incidence of yellows in Sept.—A.M.H.

1833 GRIMM, H. G. Röntgendiagnostik bei Zuckerrübensaatgut. [**X-ray diagnosis of sugar-beet seed.**] *Zucker* 1958, **11**, No. 13, 302–6, bibl. 5, illus. [Forschungsanst. für Landwirtsch., Braunschweig-Völkenrode, W. Germany]

This is a preliminary communication on the use of X-ray photography for determining seed viability in segmented and normal seed of sugar-beet. It may also be used to find out if fertilization has taken place after pollination. The latter use is of interest chiefly to the plant breeder.—D.B.

1834 LAWSON, W. A. **Gibberellic acid as a growth accelerator on sugar beets.** *J. Amer. Soc. Sug. Beet Technol.* 1958, **10**, No. 2, 181–6, bibl. 6, illus. [Consol. Foods Corpor., Betteravia, California]

Sugar-beet, var. US 56/2, grown in vermiculite

culture, was treated as follows : (a) seed soaked in 10 ppm. GA, (b) 4 applications of 1000 μg. GA to the vermiculite at intervals of 30 days, (c) 4 applications of 30 μg. GA as a foliar spray at intervals of 30 days. Beet plants given treatment (c) produced significantly taller and heavier top-growth than the controls. Treatments (a) (b) and (c) had no significant effect on root weight or sucrose content.—R.B.

1835 Artschwager, E. and Brewbaker, H. E. **Correlation studies of chemical and morphological characters of sugar beet variety GW 413.** *J. Amer. Soc. Sug. Beet Technol.* 1957, **9,** No. 7, 576–82, bibl. 6.

Representative roots of greater than average size from a population of sugar-beets of a variety known to be genetically heterogeneous were tested to determine any effective correlations between anatomical characters and important chemical characteristics. Significant correlations were found between vascular ring density and percentage sucrose, and between ring density and sucrose purity.—D.A.L.

1836 Orchard, B. **Growth analysis. The effect of soil moisture deficit on plant growth.** *Rep. Rothamsted Exp. Sta. 1958,* Harpenden, 1959, 79–80.

The work described in *Fld Crop Abstr.* 12 : 219 was continued. Sugar-beet grown under Dutch lights received the following irrigation treatments: (a) minimal water stress maintained by frequent waterings (14 in. water applied in June–Sept.); (b) early drought, i.e. 3 drought cycles during June–July, with the plots watered just before permanent wilting point was reached at the end of each cycle ; watering as in (a) in Aug. and Sept. (10 in. water applied) ; (c) late drought, i.e. watered as in (a) until the end of June, then no water applied except 1 in. in late Sept. (5·5 in. water applied). By the end of July, plants in (b) had a slightly lower dry weight than the others, due to a decrease in leaf-area index (L) and not in net assimilation rate (E). In the fortnight after watering was resumed, the plants in (b) had a higher E than the rest ; L also increased. Throughout Aug. and Sept., L for treatment (c) fell steadily, while that for (a) remained nearly constant.—A.M.H.

1837 Vellard, J. La glutamine de la betterave sucrière et son influence sur la valeur de l'azote nuisible. [**Glutamin in sugar-beet and its influence on the value of noxious nitrogen.**] *C.R. Acad. Agric. Fr.* 1958, **44,** No. 18, 898–901.

Determinations of the constituents of sugar-beet roots during growth were made at weekly intervals from June until harvest (13 Oct.–30 Nov.). There was an active synthesis of sugar from the 10th to the 161st days of growth. From the 161st to the 182nd day of growth the sugar content remained practically constant, while the non-sugar constituents decreased and the glutamin content increased ; from the 182nd day until lifting (196th day) the sugar content increased slightly, the glutamin content decreased and the non-sugar constituents increased considerably. In view of the industrial value of glutamin, there would be an advantage in harvesting at about the 182nd day of growth.—E.B.O.

1838 Jorritsma, J. De bemesting van suikerbieten. 1. Stikstof-kali-magnesium proefvelden 1946 t/m 1951. **The manuring of sugar-beet. 1. Nitrogen-potassium-magnesium field-trials, 1946-51 inclusive.** *Meded. Inst. rat. Suikerprod.* 1958, **26,** No. 5, 227–98, illus., English and French summaries.

The effects of varying levels of N, K and Mg fertilization on the mineral content of sugar-beet leaves, tops and roots are described.—R.B.

1839 Dijkema, L. R. Enkele opmerkingen over de stikstofbemesting op suikerbieten in de Wieringermeer. [**Observations on manuring sugar-beet with nitrogen in the Wieringermeer Polder.**] *LandbVoorl.* 1958, **15,** No. 12, 641–8.

The average amount of N fertilizer applied to sugar-beet on the normal clay and gravel soils of the Wieringermeer Polder during the first 25 years of its existence, was about 800 kg./ha. before 1940 and during the period 1946–57, 1000 to 1100 kg. nitrate of lime per ha. The average post-war sugar content of the crops has frequently been 0·5 to 0·9% lower than that of crops on comparable land in the older Netherlands. Recently a reaction in favour of applying lower quantities of N has set in and results obtained from 11 experimental fields show that, where there is no green manuring, the application of 600 kg. nitrate of lime per ha. is adequate to ensure maximum sugar production per ha. Where there is effective green manuring, 300 kg. per ha. is sufficient. F. s.—G.M.R.

POTATOES

See also Abs. 1800, 2013, 2014, 2040, 2058.

1840 Harvey, P. N. and Short, J. L. **Effect of date of planting on yield of maincrop potatoes.** *Exp. Husb.* 1959, No. 4, 7–17, bibl. 6. [Norfolk Agric. Sta., Sprowston, England]

Taking the average results of a 4-yr. trial with Arran Banner and Majestic, the tuber yields from crops planted in the first week of May was 1 ton/ac. lower than from crops planted in the second week of April or third week of March. There was little difference in yield between the crops from the March and April plantings. In most years, both varieties were equally affected by late planting. Total yield was slightly better when the tubers

were planted close in the row but the yield of ware potatoes increased by 1 ton/ac. where the spacing in the row was widened from 12 in. to 20 in. F. s.—D.B.

1841 WARREN, G. C. **The influence of type of set and planting distance on grades and yields of potatoes for seed.** *Amer. Potato J.* 1958, **35**, No. 11, 733–8, bibl. 11. [Hort. Div., Exp. Fms Serv., Can. Dep. Agric., Ottawa, Ontario]

Whole or halved tubers, 1·5 oz. in weight, planted 6 in. apart, produced significantly higher yields of standard size seed tubers than did 1·5-oz. setts cut from tubers selected at random and planted 12 in. apart. The yield of tubers weighing 1·5–3 oz. increased and that of tubers >12-oz. decreased, as the proportion of sett size to whole-tuber size increased and the planting distance decreased. F. s.—R.B.

1842 AKELEY, R. V. **Effects of seed-cutting dates on yields of various potato varieties.** *Amer. Potato J.* 1959, **36**, No. 5, 147–53, bibl. 2. [Agric. Res. Serv., USDA, Beltsville, Maryland]

Setts of Irish Cobbler, Cherokee, Chippewa, Pungo, Katahdin, Green Mountain and Kennebec were cut on 9 dates between 10 Sept. and 11 May, and grown at 3–4 locations. Tuber yields were not significantly influenced by date of cutting. Yields of Sebago were significantly lowered only where setts were planted in S. Carolina immediately after cutting on 15 Feb.—R.B.

1843 KARTOFFELBAU. **Potato chitting.** *Kartoffelbau* 1959, **10**, No. 2.

A series of papers on potato chitting, mainly of an advisory nature, appears in the above issue of *Kartoffelbau*. The series includes the following : Chitting and early destruction of tops (Vogt) ; Practical aspects of profitable chitting (W. Raidt); Fundamentals and advantages of isolation in seed-potato cultivation (F. Bothe) ; Chitting and early destruction of tops for production of seed potato in defined cultivation areas in East Friesland (Schröder) ; Community chitting houses (Ursula Ruschke).—D.B.

1844 FULTON, J. M. **Irrigating early potatoes in southwestern Ontario.** *Publ. 1028 Can. Dep. Agric., Ottawa*, 1958, pp. 13, bibl. 7, illus.

From 1947–56, early potatoes planted in coarse-textured soils in early April yielded 300 bu./ac. in late June. From 10 years' data it was found that for maximum yields on sandy loam soil, at least one irrigation each year in late May or June was needed, and on heavier soils at least one in about half the seasons. Experiments showed that 1 in. of water every 7 days on light soils and 1·5 in. every 10 days on heavier soils was an effective plan, but additional irrigation was necessary if the available moisture at a depth of 6 in. fell to 50%. Normal cultural and fertilization practice was followed, except for slightly deeper planting. Methods for measuring soil moisture are described. —V.C.F.

1845 MYHRE, D. L. **Water-furrow irrigation of potatoes.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 4, mimeo.

Sebago potatoes were planted in Florida during 1955–8 in three 16-row beds, each bed being separated from the next by a V-shaped furrow. On each bed, 4 furrows were used for drainage, and 2 furrows for irrigation, so producing a moisture gradient across each bed. Soil moisture was approximately 6% in rows near the drainage furrows and 15% in rows near the irrigation furrows. Maximum tuber yields were obtained with a soil moisture content of 8–12%, a soil moisture tension of 0·1–0·3 atm. in the top 6 in. of the row, and a water-table approximately 2 ft. below the seed tubers.—R.B.

1846 PANENKO, I. D. [**The dependence of the irrigation regime for potatoes on method of watering and environment.** [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 263–9, bibl. 5. [Tiraspol' Exp. Sta., Moldavian SSR] [Received Aug., 1958]

There is evidence that sprinkler irrigation is the most suitable for potatoes grown in the region of the southern part of the Dniester river. The optimum amount of soil moisture varies during the vegetative period of the plant, depending on the relative humidity of the air and soil temperature.—M.H.

1847 ZABLUDA, G. V. and others. [**The effect of drought and irrigating the potato plant at different phases of development on tuber formation and yield.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 270–6, bibl. 7, illus. [Ural State Univ.] [Received Aug., 1958]

See also *Fld Crop Abstr.* 12 : 877.

1848 O'KEEFE, R. B. **Potato production in dryland rotation in western Nebraska throughout a twenty-five-year period.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 4–5, mimeo.

The most important factors influencing the yield and quality of potatoes were the amount and depth of soil-moisture at planting and the amount and distribution of seasonal rainfall. Highest yields were obtained when soil was wet to field capacity to a depth of 5 ft. at planting, followed by 2–3 in. of effective rainfall in Aug. or Sept. Potatoes yielded less following maize than following other

cereals. Highest yields were produced after summer fallow. Yields of potatoes from 5-yr. rotations tended to be greater than those from 3-yr. rotations.—R.B.

1849 Heick, F. Bewässerungsversuche in Kartoffeln und Bewässerung gegen Frostschaden. **Spray irrigation experiments with potatoes and spraying against frost damage.** *Europ. Potato J.* 1959, **2**, No. 2, 100–4, bibl. 4, English and French summaries. [Statens Forsøgsstation St. Jyndevad, Denmark]

Bintje potatoes were grown for 5 yr. in poor sandy soil with an average rainfall of 274 mm. between May and Aug.; 78 mm. water were applied as spray irrigation during this period. An average increase in tuber yield of 100 kg. dry matter/ha. was produced for each 7·4 mm. of irrigation water applied. Results from a 5-yr. trial with early potatoes showed that sprinkler irrigation significantly reduced the incidence of scab [*Streptomyces scabies*], especially at early dates of lifting. Yields were considerably increased where the crop was irrigated during nights with heavy frost. In one year when unexpected late frost occurred, potatoes irrigated the previous day suffered much less damage from frost than those not irrigated.—R.B.

1850 Hix, H. Die Verbreitung der Kartoffelsorten im Jahre 1958. [**The distribution of potato varieties in 1958.**] *Kartoffelbau* 1959, **10**, No. 2, 34–5.

In all States of Federal Germany there has been, during 1956–8, a steady increase in the cultivation of Maritta and a decrease in Ackersegen. Other important medium-late to late varieties, e.g. Bona and Heida, remained fairly constant.—D.B.

1851 Miranda, O. J. and others. Ensayos comparativos de variedades de patata (año agrícola 1955). [**Comparative trials with potato varieties, 1955.**] *An. Inst. nac. Invest. agron.* 1958, **7**, No. 4, 1059–1120.

The results are given from 8 trials to test potato varieties in different regions of Spain. Of the short-cycle varieties, Olalla yielded best in 6 trials, followed by Ari, Arana 41, Bintje, Arran Banner, Solanum, Palogán and Wiga, all of which yielded well. Of the long-cycle varieties, Arana 56, Alava, Goya and Voran yielded well.—E.B.O.

1852 Umaerus, V. **The relationship between peroxidase activity in potato leaves and resistance to *Phytophthora infestans*.** *Amer. Potato J.* 1959, **36**, No. 4, 124–131, bibl. 17. [Iowa Agric. Exp. Sta., Ames]

A positive correlation between field resistance to late blight and peroxidase activity in the leaves was found in *Solanum tuberosum*, but not in *Solanum demissum*. F. s.—R.B.

1853 Wang, T. P. and Hwang, H. **Experiments on the control of potato late blight by organic mercurial dusts.** [Chinese] *Acta phytopath. sinica* 1958, **4**, No. 1, 81–6, bibl. 8, English summary. [Salingtze Agric. Exp. Sta., Hopeh; and Inst. Applied Mycol., Academia Sinica]

In field trials, 2 mercurial dusts (2% ethyl mercuric chloride and 2·58% phenyl mercuric acetate), each mixed with hydrated lime as diluent and applied 5 times at 7-day intervals beginning with the appearance of the disease, gave good control of *Phytophthora infestans* and increased potato yields. Hydrated lime proved to be better than talc as a diluent; the reason for this is not known. F. Eng. s.—D.B.

1854 Guntz, M. and Coppenet, M. Essais de traitements contre la gale commune de la pomme de terre. [**Trial treatments of the soil against common scab of potatoes.**] *Phytiat.-Phytopharm.* 1957, **6**, 187–95, bibl. 4. [Sta. Agron., Quimper, France]

The results from preliminary trials in Brittany showed a beneficial effect from treating the soil with sulphur or pentachloronitrobenzene for controlling potato scab (*Streptomyces scabies*). Manganese sulphate, applied to the soil at a rate of 500 kg./ha., markedly reduced the disease.—E.B.O.

1855 Boer, H. ten. Voortzetting van het Rizoctoniaonderzoek. [**Continuation of *Rhizoctonia* studies.**] *LandbVoorl.* 1959, **16**, No. 2, 84–8. [State Agric. Adv. Serv., North Groningen, Netherlands]

In 2 comparisons in which healthy and *Rhizoctonia*-infected seed potatoes were planted, the use of healthy seed, by giving a crop with better-sized and fewer malformed tubers, resulted in a financial gain of 900 and 1500 florins per ha., respectively. Disinfection of infected seed potatoes did not reduce the incidence of infection in the crop, but resulted in financial gains of 400 and 800 florins per ha., because better-sized and fewer malformed tubers were produced. Comparison of disinfection with Hg compounds and fumigation with rhizotox proved the 2 treatments to be of approximately equal value. Combining Hg treatment with fumigation produced 100% kill of sclerotia and improved the soundness of the tubers harvested. Germination appeared to be delayed by fumigation and the treated tubers required to be sprouted before planting. Comparison of different times of disinfection showed that seed potatoes withstood treatment well, except those harvested when still immature. [See also *Fld Crop Abstr.* 11 : 1639.]—G.M.R.

1856 Fischnich, O. and Grimm, H. Aufhebung der Keimruhe von Kartoffelsamen durch Gibberellin. Vorläufige Mitteilung. [**Breaking dormancy in potato seed (true) by gibberellin (preliminary communication).**] *Landbauforschung Völkenrode* 1958, **8**, No. 4, 95–6, bibl. 7, illus. [Inst. PflBau u. Saatguterzeugung, Braunschweig-Völkenrode, W. Germany]

1857 Humphries, E. C. **Effect of gibberellic acid on leaf growth and net assimilation rate.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 75–6.

In a previous experiment [see *Fld Crop Abstr.* 12 : 1386] Majestic potato plants sprayed twice with GA at an interval of 1 week had more dry weight than unsprayed plants at 4 weeks after spraying, but it was doubtful whether the advantage would have persisted, since the leaf area of the sprayed plants was decreasing more rapidly than that of the unsprayed by this time. In 1958, treatments involving 4 additional sprayings with GA at weekly intervals were also included, with high and low levels of N. Three weeks after spraying began, GA had increased the total dry weight per plant, though not significantly in the low-N plants, and decreased the weight of tubers. By 5 weeks after the 1st spraying, the dry weight of sprayed high-N plants was about 10% more than that of the controls, but spraying had decreased the dry weight of the low-N plants. At 8 weeks after the 1st spraying, the high-N plants that had only been sprayed twice still had a higher dry weight than the unsprayed controls, but those that had been sprayed 6 times had the same dry weight as the controls. Both spraying treatments had decreased the dry weight of the low-N plants at this stage. GA increased the area of leaves on the main axis and lateral branches especially in low-N plants.—A.M.H.

1858 Wilkens, W. F. **The effect of gibberellins on production of the Russet Burbank potato.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 11, mimeo.

Foliage of Russet Burbank potatoes was sprayed with GA at 0·01, 0·1, 1, 10 and 100 ppm. before, during and after, flowering. Total yield of tubers was unaffected by any of the treatments. The yield of U.S. No. 1 ware potatoes was reduced by treatment with 100 ppm. GA at the time of flowering, but not by any of the other treatments. Cut setts treated with GA at 10 and 100 ppm., but not those treated with GA at < 1 ppm., emerged earlier and produced the most stems. Elongated, chlorotic plants resulted from treatment with 100 ppm. GA, and slight elongation, without chlorosis, resulted from the 10 ppm. treatment.—R.B.

1859 Craft, C. C. and Audia, W. V. **Some effects of CIPC (isopropyl N-(3-chlorophenyl) carbamate) on respiration, water uptake and ion leakage of potato tissue.** *Abstr. 42nd. ann. Meet. Potato Ass. Amer.* 1958, 1–2, mimeo.

The effects of CIPC on potato tissue were compared with those of GA and NAA. CIPC and GA, alone and in combination, applied as a liquid dip, had no consistent effect on the O_2 uptake of small tubers. Volatilized CIPC at very low concentrations was toxic to potato discs, but O_2 uptake was not significantly affected until the potato cells died. NAA increased water uptake of potato tissue when applied alone or with GA, but not when CIPC was present ; CIPC and GA had no significant effect on water uptake. CIPC and NAA, but not GA, caused an increase in ion leakage from potato tissue. CIPC caused a significant reduction in the accumulation of *o*-dihydroxyphenols by potato discs.—R.B.

1860 Gausman, H. W. and others. **Effects of certain growth substances on number of potato tubers.** *Amer. Potato J.* 1958, **35**, No. 11, 742–6, bibl. 13. [Maine Agric. Exp. Sta., Orono]

Kennebec potato setts, grown in nutrient solution in sand culture, were pruned on emergence to leave one aerial stem. At the onset of flowering, before and during tuber formation, rhizomes were injected with aqueous solutions of 2,4-dichloranisole (DCA), 2,3,5-triiodobenzoic acid (TIBA), indoleacetic acid (IAA), 2-naphthaleneacetic acid (NAA) and dalapon at varying concentrations. When applied during tuber formation, dalapon and TIBA tended to increase the number of tubers per plant, and DCA the number of rhizomes per plant. TIBA, DCA and IAA applied before tuber formation tended to increase the number of rhizomes per plant. Katahdin potato setts grown in pots in soil adequately fertilized with N, P, K and Mg were pruned as above. Solutions of 100 ppm. TIBA, 100 ppm. NAA, 2000 ppm. DCA, 1000 ppm. IAA and 1000 ppm. dalapon were applied during tuberization as a 20 ml. leaf spray or as a 150 ml. irrigant. DCA increased the number of tubers per plant by 52% without affecting their dry weight, and 1·34 tubers per rhizome were formed. DCA appeared to affect apical dominance. NAA decreased tuber dry weight and increased tuber sp. gr. NAA was more effective as a leaf spray, DCA as an irrigant.—R.B.

1861 Bokarev, K. S. and others. **The use of xanthogenates for the withdrawal of potato tubers from the dormant state.** [Russian] *Izv. Akad. Nauk SSSR (Bull. Acad. Sci. USSR, Biol. Ser.)* 1959, No. 3, 446–50, bibl. 9, illus., English summary. [Timirjazev Inst. Pl. Physiol.]

1862 Livingston, C. H. **The effects of various chemicals on the cut surface of seed potatoes.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 2–3, mimeo.

The effect of catechol, semesan-bel and agrimycin 100 [streptomycin] applied as dip treatments, and the action of running water, on cut surfaces of Red Pontiac tubers was investigated. Tubers treated with catechol or semesan-bel developed a relatively thicker layer of suberin than did the controls. Running water applied to a cut surface for 3 hr. did not remove substances essential to suberization or periderm initiation. The time of initiation of periclinal walls was not noticeably affected by any of the treatments. There was considerable variation in the date of periderm formation between tubers from the same hill. Depletion of starch occurred in the cells directly below the cut surfaces.—R.B.

1863 Thijn, G. A. **Above-ground tuber formation of potatoes.** *Euphytica* 1959, **8**, No. 1, 95–7, bibl. 1, illus., Dutch summary. [Stichting voor Plantenveredeling, Wageningen, Netherlands]

1864 Werner, H. O. **Extent of root growth of potato plants.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 11, mimeo.

Several potato varieties of differing vegetative characteristics were grown in soil in long plastic tubes. The percentages of the total root production, on a dry-weight basis, recovered from 7 successive 300 cm. sections of the soil from ground level to a depth of 2·1 m., were 53, 18·9, 12·8, 6·6, 4·5, 2·2 and 1·4, respectively. The remaining 1·5% was at a depth between 2·1 and 3 m. Potatoes planted in the field in soil wet to field capacity were protected from further rainfall. The mean percentage of total water from various depths used by plants of all varieties was : 0–6 in., 27·9% ; 6–12 in., 14·6% ; 1–2 ft., 23·4%; 2–3 ft., 18·3% ; 3–4 ft., 14·6 %; 4–5 ft., 1·2%; There was relatively little difference between varieties in root production and depth of water removal until 24 August. After that date, the difference in depth of root penetration and water removal were proportional to the extent of retention of healthy green leaves.—R.B.

1865 Joseph, E. and others. Contribution à l'étude de la tubérisation chez la pomme de terre. **Study on the development of potato tubers.** *Europ. Potato J.* 1959, **2**, No. 1, 1–21, bibl. 10, illus., English and German summaries. [Sta. Féd. Essais Agric., Lausanne, Switzerland]

Potatoes, var. Eersteling, Sirtema, Bintje, Bona, Augusta, Ackersegen, Benedikta and Voran were grown in 1956–7 at a uniform level of fertilization and lifted on 4 dates in June and July, as well as at maturity in Sept. Tubers were allowed to sprout for 5 weeks before planting in 1956 and for 19 days in 1957. The total number of eyes per tuber did not vary greatly between varieties. The number of sprouted eyes per tuber and the number of main shoots produced per plant was not related to the earliness or lateness of the varieties. Plants developing from tubers sprouted for 5 weeks produced relatively fewer main shoots, relatively more side shoots and fewer, though larger, tubers at maturity than those from tubers sprouted for 19 days. The average daily increment in yield for early and mid-season varieties was as much as 800 kg./ha./day between 30 and 50 days after tuber initiation. In maincrop varieties the rate of tuber growth was slower, but was maintained over a longer period. Sprouting for 5 weeks gave the highest yields of 32–50 mm. grade seed potatoes in mid-season varieties (Bintje) and maincrop varieties (Ackersegen) lifted in mid-July, whereas yields of seed potatoes lifted in Sept. were independent of sprouting treatment. In early varieties, such as Sirtema, sprouting for 19 days gave the highest yields of seed potatoes at both lifting dates.—R.B.

1866 Sidoryk, S. Wpływ terminów sadzenia ziemniaków na przebieg ich wegetacji. **The influence of the period of planting potatoes on their vegetation.** *Roczn. Nauk rol.* 1959, **79**, Ser. A, No. 3, 851–75, bibl. 10, Russian and English summaries.

Studies over several years have confirmed that the length of the vegetative period in any one variety of potato fluctuates greatly, depending on the weather and time of planting. Potatoes planted during the second half of April in the Poznan area (i.e. when the soil temperature is 8–10°C.) begin to sprout after 26–32 days, depending on the variety and on temperature changes. In general, as the soil temperature rises to 18 or 19°C. the period from planting to sprouting becomes shorter. After the appearance of the shoots above ground, growth depends on temperature, light and rainfall. Dry and hot weather retards development from flower-bud formation to flowering. In Poland, the second half of May is usually colder than June, July and August and therefore potatoes which begin sprouting in the second half of May, after planting in April, show a tendency to prolong the period of development from sprouting to flower-bud formation by one to several days. In general, however, delaying the time of planting does not exert any practical influence on rapidity of development from sprouting to budding, or from budding to flowering. On the other hand, the period from flowering to drying of the leaves becomes shorter as the times of planting are delayed. The chemical composition of the leaves is not affected by planting date which is therefore not

considered a factor for control of the Colorado beetle. F. s.—M.H.

1867 Madec, P. and Perennec, P. Le rôle respectif du feuillage et du tubercule-mère dans la tubérisation de la pomme de terre. **The part played by leaves and the mother tuber respectively in tuberisation of the potato.** *Europ. Potato J.* 1959, **2,** No. 1, 22–49, bibl. 54, illus., English and German summaries. [Sta. Amél. Pomme de Terre, Landerneau, France]

Tubers of Bintje, Ackersegen, Morgane, Viola and Etoile du Léon were stored for 114 days at (a) 16–18°C., (b) 5–10°C. (Bintje and Ackersegen only), or (c) 2–4°C. All sprouts were then removed and the tubers allowed to sprout for 33 days before planting. Tuber initiation occurred later in treatment (c) than in treatments (b) or (a). Tubers from the same samples allowed to sprout for 66 days and then planted in damp vermiculite in darkness at 15°C. showed a similar delay in tuber initiation following treatment (c). The time required for tuber initiation appeared to be influenced by the physiological age of the mother tuber. The results of trials in which tomato shoots were grafted on Bintje stocks showed that the mother tuber was capable, by itself, of inducing tuber formation. The results of further trials indicated a considerable difference between varieties in the relative effect of the leaves and mother tubers on the initiation of new tubers.—R.B.

1868 Birecki, M. and Somorowska, K. Wpływ różnych sposobów jarowizowania na wysokość i jakość plonu ziemniaków. **The influence of various methods of vernalization on the quality of potato crops.** *Roczn. Nauk rol.* 1959, **79,** Ser. A, No. 3, 781–95, bibl. 8, Russian and English summaries.

Field tests were conducted over the period 1954–6 in which comparisons were made between the development and yields of non-vernalized potatoes, and growth, development and yields of sprouted potatoes vernalized : (1) in boxes, (2) on threshing floors, (3) in ditches, (4) on the surface of the ground. These studies showed that irrespective of the method of sprouting, vernalization accelerates developmental stages (seedling growth, formation of buds, blooming, formation of tubers and maturing). F. s.—M.H.

1869 Isleib, D. R. and Thompson, N. R. **The influence of temperature on the rate of root and sprout growth of potatoes.** *Amer. Potato J.* 1959, **36,** No. 5, 173–8, bibl. 3, illus. [Michigan Agric. Exp. Sta., E. Lansing]

Cut setts of Sebago planted in damp vermiculite failed to sprout at 45°F., and sprouted little at 46 or 48°F. ; slow growth occurred at 50°F., and relatively rapid growth at 52°F. or above. Setts of the early variety Onaway grown in vermiculite at 46, 48, 50 and 52°F. sprouted more rapidly than did those of Katahdin at equivalent temperatures. The critical temperature for growth of 10 varieties similarly tested was between 48 and 50°F. ; the rate of sprout and root growth was not consistently associated with varietal earliness or lateness.—R.B.

1870 Letnes, A. **The effect of soil moisture on the sprouting of potatoes.** *Europ. Potato J.* 1958, **1,** No. 4, 27–32, bibl. 1, French and German summaries. [Hveem Forsøks- og Stamsaedgård for Poteter, Bilitt Ø. Toten, Norway]

Potatoes of 3 varieties which had been stored at 3–5°C. at a relative humidity of 85–90%, were planted in a glasshouse in pots containing air-dry, damp, and water-saturated soil in spring 1952, and 5 varieties stored at 3–5°C. at a relative humidity of 2–4% were similar treated in 1956. Tubers planted in air-dry soil lost weight, and most failed to sprout. No roots were produced. After watering to produce a normal soil-moisture content, the tubers sprouted normally. Tubers planted in soil of normal moisture-content gained in weight before they sprouted. The rate of water absorption varied among varieties, and increased up to the time of sprouting. Tubers planted in saturated soil increased in weight in 1952, only, and most decayed within a few days.—R.B.

1871 Pfeffer, C. Der Einfluss des Krautziehens auf Triebkraft und Ertrag von Pflanzkartoffeln. [**The effect of removal of tops on the sprouting ability and yields of seed potatoes.**] *Z. Acker- u. PflBau* 1959, **107,** No. 3, 335–50, bibl. 12, English summary. [Inst. PflZücht. Gross-Lüsewitz, E. Germany]

Some consequences of early removal of the haulm of potato plants grown for seed on the storage properties, dormancy, sprouting ability, and yield of the subsequent crop in several varieties of potatoes was studied in a virus-free area. Any disadvantages, such as shortening of dormancy and increased rotting during storage, can be partially overcome by early planting of sprouted seed potatoes so that the tubers are as mature as possible before the tops are removed.—D.B.

1872 Kashibuchi, H. and Iwane, K. **Studies on the effects of MH-30 to the restraint of the sprouting of the potatoes.** [Japanese] *J. Fac. Agric. Iwate* 1957, **3,** No. 3, 373–81, bibl. 5, illus., English summary.

For inhibiting sprouting of potatoes, the most suitable concentration of MH-30 solution was 0·15 – 0·25%, and the best times for spraying were the early and middle stages of tuber growth. No changes in quality were detected and the potatoes were edible. F. Eng. s.—D.B.

1873 Timm, H. and others. **Investigations with maleic hydrazide on potatoes. 1. Effect of time of application and concentration upon potato performance.** *Amer. Potato J.* 1959, **36,** No. 4, 115–23, bibl. 11. [Univ. California, Davis]

Potatoes, var. White Rose, Russet Burbank, Kennebec, Redkote and Pontiac, were sprayed by hand 2 or 3 weeks before harvest with 1000, 2000, 3000, 4000 and 6000 ppm. MH. Treatment had no significant effect on yield, sp. gr. of tubers, or cooking quality. When stored for 6 months at 45–55°F. or 68°F., the fresh weight of sprouts produced by the tubers progressively decreased with increasing concentrations of MH. Sprouting was not completely suppressed at the highest concentration of MH. Untreated tubers sprouted profusely. Treatment with MH decreased the loss in tuber weight during storage as compared with the controls. The loss in weight and the amount of sprouting during storage was considerably less at the lower than at the higher storage temperature.—R.B.

1874 Went, F. W. **Effects of environment of parent and grandparent generations on tuber production by potatoes.** *Amer. J. Bot.* 1959, **46,** No. 4, 277–82, bibl. 7. [Missouri Bot. Gdn, St. Louis]

A clone of Kennebec Wonder potatoes was grown in the laboratory for 4 generations in order to determine the effect of climate on seed-potato production. Tubers were stored at 20°C. for 1 month before planting, cut into setts containing one eye and weighing 10–15 g., and transferred 3 weeks after planting to 8-hr. photoperiods, and various combinations of day temperatures (30, 26, 23, 20 or 17°C.) and night temperatures (23, 20, 17, 14, 12 or 10°C.). Top weight decreased and tuber weight increased as night temperatures decreased, but the number of tubers formed was not affected. Decreasing day temperature had little effect on the total weight of tubers produced, but markedly decreased the weight of tops and increased the number of tubers formed. The fresh weight of the whole plants was similar under all growing conditions. Plants developed from tubers formed in cool conditions invariably produced more and heavier tubers than did plants from tubers formed in warm conditions ; this effect was highly significant in the second generation also. The greatest increase in yield occurred where the parent or grandparent tubers were formed at night temperatures of 14°C. Results similar to those described above were obtained where tubers grown from plants raised under a variety of environmental conditions, were stored for a short time at 7°C. and grown at 23°C. day- and 17°C. night-temperature for 110 days with a 16-hr. photoperiod, and, subsequently, with a 10-hr. photoperiod. Tubers stored in darkness for 8 months at 20°C. formed secondary tubers, eyes from which were planted and grown ; the influence of growing conditions in the parental generation on tuber yields from these plants was very much less than where tubers were stored for 1 month, only. Subjective tests indicated that those grown at 17°C. day temperature and 10°C. night temperature with 8-hr. days had the best flavour.—R.B.

1875 Mackey, Andrea and others. **Survey of specific gravity of Russet Burbank potatoes grown in central Oregon and the Klamath Basin, 1957 crop.** *Amer. Potato J.* 1958, **35,** No. 11, 739–41, bibl. 1, illus. [Oregon Agric. Exp. Sta., Corvallis]

The sp. gr. of Russet Burbank potato samples from 108 farms ranged from 1·07 to 1·12 ; 86% of the samples were between 1·085 and 1·105, 62% between 1·09 and 1·1. The average sp. gr. was 1·092.—R.B.

1876 Sheard, R. W. and Johnson, G. R. **Influence of nitrogen, phosphorus and potassium on the cooking quality of potatoes.** *Canad. J. Pl. Sci.* 1958, **38,** No. 4, 394–400, bibl. 16. [Dep. Soils, Ontario Agric. Coll., Guelph]

Dry-matter content of Katahdin potatoes grown on 7 different soils in 1955 and '56 was sometimes increased by P, consistently decreased by K, and slightly decreased by N. Consumer preference index (based on subjective evaluation of texture, flavour and colour) was increased by both P and K and was variable for N. The differences were small in relation to those associated with soils and weather and no changes are recommended in fertilizer procedure. Fertilizer application markedly increased yield. F. s.—J.D.J.

1877 Mann, P. J. G. **Blackening of potatoes after boiling.** *Rep. Rothamsted Exp. Sta. 1958,* Harpenden, 1959, 90–2.

Observations were in agreement with the hypothesis that blackening is due to liberation of ferrous iron, which combines with the dihydroxyphenols of the potato to give colourless ferrone complexes ; these oxidize in air to give intensely coloured ferric complexes. Blackening was prevented by adding citrate, pyrophosphate or ethylenediamine tetra-acetate to the water in which the potatoes were boiled. Citric-acid estimations suggested an inverse relationship between citric-acid concentration and intensity of blackening.—A.M.H.

1878 Sparks, W. C. **Effect of high temperatures on internal blackening of potato tubers treated with sprout inhibitors and gamma rays.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 10, mimeo.

Internal blackening appeared in tubers treated with γ-rays or sprout inhibitors and stored at 100°F. for 36 hr. Blackening increased with increasing radiation dosages. Tubers given low dosages of γ-rays developed hollow centres, but did not blacken. Tubers treated with CIPC or MENA became brownish, and those treated with MH did not darken.—R.B.

1879 O'Keefe, R. B. and Werner, H. O. **Preliminary report on physiological and genetic studies of heat resistance in *Solanum tuberosum*.** *Abstr. 42nd ann. Meet. Potato Ass. Amer.* 1958, 5–6, mimeo.

Potato varieties differed greatly in physiological responses to high temperature or lack of soil moisture and in the extent and nature of tissue destruction under these conditions. Among plants subjected to temperatures of 116°F. at 60% relative humidity for 5 hr., direct correlations were found (a) between severity of wilting and extent of tissue destruction, (b) between tissue destruction, plant height, and magnitude of subsequent lateral plant growth. Tuber production was inversely proportional to the extent of tissue destruction and secondary growth of plant tops. The maximum temperature which plants of various clones could withstand without suffering direct heat injury was slightly lower in original seedling plants than in plants grown from tubers. It was considered possible to select for heat resistance in potatoes.—R.B.

1880 Nultsch, W. Versuche zum Nachweis von Isopropyl-N-phenylcarbamat (IPC) an und in behandelten Kartoffelknollen. [**Tests to detect isopropyl-N-phenylcarbamate (IPC) in treated potato tubers.**] *Angew. Bot.* 1959, **33**, No. 1, 10–18, bibl. 10. [Biol. Inst. des VEB, Fahlberg-List, Magdeburg SO, Germany]

Tests were carried out to discover if, and to what extent, IPC penetrated the tissues of potato tubers treated with this sprout-inhibiting substance. By the method used (the photometric determination of anilin which is a product of hydrolysis of IPC) 1 mg. IPC per kg. potato could be detected. In 500 g. of unpeeled potatoes, treated for 1 yr. with a formulation containing 5% IPC at the rate of 200 g./100 kg., only 0·3 mg. IPC was detected and this was in the skin. In peeled potatoes so treated there was no trace of IPC. Following a discussion of the possible toxicity of IPC to the consumer, it was concluded that IPC could be safely used on potatoes.—D.B.

1881 Brücher, H. Kritische Betrachtungen zur Nomenklatur argentinischer Wildkartoffeln. 5. Die Serie *Acaulia*. [**Some critical reflections on the nomenclature of Argentine wild potatoes. 5. The series *Acaulia*.**] *Züchter* 1959, **29**, No. 3, 149–56, bibl. 11, illus. [Esta. Exp. Minist. Agric., Lujan, Mendoza, Argentina]

See also *Fld Crop Abstr.* 11 : 1137.

1882 Hawkes, J. G. **Significance of wild species and primitive forms for potato breeding.** *Euphytica* 1958, **7**, No. 3, 257–70, bibl. 28. [Univ. Birmingham]

1883 Klapp, E. Hackfruchtforschung. [**Root-crop research.**] *Rep. World Congr. agric. Res., Rome*, 1959, pp. 22, French, English, Spanish and Italian summaries. [Inst. PflBau, Univ. Bonn, W. Germany]

Recent developments in research on potato- and sugar-beet-cultivation are reviewed from 1000 papers, approx.—D.B.

1884 Kartoffelbau. **Manuring of potatoes.** *Kartoffelbau* 1959, **10**, No. 1.

The following series of papers on manuring for potato cultivation appears in the above issue : Soil condition and fertility and its importance for potato growth (F. Nieschlag) ; The humus problem in intensive cultivation (K. Bräunlich) ; Sweet lupin as a green manure for potatoes (J. Hackbarth) ; Importance of phosphate manuring in potato cultivation (H.-D. Bergemann) ; High starch yield by correct manuring (H.-H. Soll) ; Cultivation of starch potatoes on light soils (—. Ziffer) ; Potato manuring in Bavaria (—. Seischab) ; Lime and magnesia manuring on light soils (F. Nieschlag) ; Effect of a Mg dressing for potatoes as related to soil pH and the form in which N is applied (W. Werner) ; Manuring and cultivation technique for pre-sprouted stands [of potatoes] (—. H. Schleusener).—D.B.

1885 Franc de Ferrière, P. J. J. and Quidet, P. Fumure potassique de la pomme de terre et du blé en fonction des types d'argile des sols. [**K manuring of potato and wheat in relation to types of soil clay.**] *C.R. Acad. Agric. Fr.* 1958, **44**, No. 2, 94–104.

[See also Abs. 575, 801 and 1684.]

1886 Hawkins, W. W. and others. **Some biochemical changes on storage in potatoes from Prince Edward Island, and their relation to the quality of chips.** *Canad. J. Pl. Sci.* 1958, **38**, No. 4, 457–63, bibl. 17. [Atlantic Reg. Lab., Nat. Res. Coun., Halifax, Nova Scotia]

Varieties of potatoes were examined for water, starch and reducing-sugar content and for changes therein at different temperatures. Above a critical concentration of 0·4% reducing sugar, potato chips [crisps] made from the potatoes were dark brown and unacceptable in flavour. In potatoes stored at 35°F., the reducing-sugar content of all varieties rose to between 1·5 and 4·0% in 5–14 weeks ; and

in those stored at 50°F. it usually rose above 0·4% in 9–13 weeks. In Sebago, and to a lesser extent in Katahdin, shrinkage and rot developed when the temperature was raised to 70°F., and the chips produced were poor in texture and flavour. Where Netted Gem, Green Mountain and Irish Cobbler potatoes were stored at 70°F., their reducing-sugar content fell below 0·4% in 3–9 weeks and the chips were of acceptable quality ; the first and last of these varieties were best. F. s.—J.D.J.

1887 Jong, W. H. de and Hofstra, D. **The keeping quality of seed potatoes.** [English, French and German] *Europ. Potato J.* 1958, **1,** No. 4, 33–42. [Inst. Bewar. Verwerk. LandbProd., Wageningen, Netherlands]

Potatoes, var. Bintje, were lifted in July 1948 and stored in a clamp, from which tuber samples were removed at monthly intervals from Aug., 1948, until April, 1949, before being transferred to storage at 2°C. Tubers which had been pre-sprouted for 6 weeks, and non-sprouted tubers, were planted in the field in April and Aug., 1949. Tubers stored in the clamp until Dec., 1948, but not longer, showed no deterioration in stand when pre-sprouted and planted in spring, while those stored in the clamp until after Oct. showed a reduction in stand when planted in spring without pre-sprouting. Those removed from the clamp after Sept., 1948, gave reduced stands when planted in Aug., 1949, with or without pre-sprouting. Tubers of 10 varieties, stored at 2°C. for 10 or 22 months, were pre-sprouted for 7 weeks and sown in May, 1950. All varieties stored for 10 months produced a good stand ; Meerlander, Noordeling, Bevelander and Libertas produced almost equally good stands when stored for 22 months. Record and Libertas tubers stored for 2 years 8 months gave 70 and 60% emergence. Noordeling tubers were still capable of sprouting after 3·5 yr. of storage.—R.B.

1888 Cairaschi, E. A. and Carton, H. Effets des émanations du crésyl sur la germination des plants de pommes de terre. Incidence sur les techniques de conservation. [**Effects of cresyl emanations on the germination of seed potatoes. Influence on storage methods.**] *C.R. Acad. Agric. Fr.* 1958, **44,** No. 6, 345–9, bibl. 3. [Inst. Nat. Rech. Agron., France]

From trials and observations on seed potatoes from the 1955–6 harvests stored in the region of La Ferté-Milon, Aisne, it was concluded that cresyl (commercial preparation consisting of 70% phenol compounds and 30% emulsifiers) in addition to its use for disinfecting potato warehouses (mainly for control of Fusarium disease) can be used for inhibiting the germination of seed potatoes. For this purpose the sacks, in which the potatoes will be stored, are steeped in a 10% cresyl solution and then partly dried. Aeration increases the effect of the cresyl emanations. This treatment is cheap and does not affect the growth of the plants. It is considered particularly suitable for regions, such as Britanny, which have a milder climate than Aisne. —E.B.O.

1889 Péquart, S.-J. La conservation des pommes de terre par les radiations ionisantes. [**Potato conservation by ionizing radiation.**] *Pomme d. Terre franç.* 1959, **22,** No. 235, 18–23, bibl. 10, illus.

1890 Hine, H. J. **Mechanical damage to potatoes.** *Agriculture, Lond.* 1959, **65,** No. 12, 608–11.

Precautions during cultivation operations, adjustments to machinery (especially the elevator-digger) and care during transport and sorting are among the measures discussed to prevent mechanical damage to potato tubers.—D.B.

1891 Reestman, A. J. and Zaag, D. E. van der. Enkele waarnemingen over de teelt en de afzet van aardappelen in Frankrijk. [**Some observations on the cultivation and sale of potatoes in France.**] *Meded. Proefst. Akker. Weidebouw* 1958, pp. 15, bibl. 1, illus., mimeo.

Observations made on a tour in France are considered, chiefly from the Netherlands exporters' viewpoint. Certified seed potatoes are used on about one-quarter, only, of the French potato acreage. French breeders seek strains which possess a better resistance in the field to *Phytophthora* than does the Dutch variety Bintje and which have a quality enabling the tubers to be cooked in any of the usual ways. Control of quality, hitherto organized on a voluntary basis, has been replaced by legally-enforcible State control of wholesale and retail trade in culinary potatoes, the protection of varietal names being an important point. Under this system, which began in September 1958, the varieties which may be sold are listed. F. s.—G.M.R.

1892 Bureau of Agricultural Economics, Canberra. **The Australian potato industry.** *Bull. 5 Bur. Agric. Econ., Canberra* 1949, pp. 67, bibl. 17. [Received May, 1959]

This publication reviews production, consumption and marketing of potatoes in Australia up to 1949.—A.M.H.

1893 Lugt, C. Recherches sur la qualité organoleptique. L'emploi d'une épreuve par couples en cas d'une comparison de plus de deux variantes. [**Investigation of organoleptic quality. The use of paired tests in the comparison of more than two treatments.**] *Europ. Potato J.* 1958, **1,** No. 4, 20–6, bibl. 1, English and

German summaries. [Inst. Biol. Scheik. Onderz. LandbGew., Wageningen, Netherlands]

Potatoes of one variety were planted and harvested on the same dates on 5 different soils which had received identical amounts of fertilizer. After harvest, tubers from each treatment were compared with tubers from each of the other treatments by 3 observers in 9 subjective tests with uncooked tubers and 6 subjective tests with cooked tubers. Differences between treatments were very small, but significant. It was considered possible to conduct exact research using subjective testing.—R.B.

SWEET-POTATOES

1894 Department of Agriculture, Federation of Malaya. **[Sweet-potatoes.]** *Rep. Dep. Agric. Malaya 1956*, 1958, 68–9, illus.

The yields of both tops and tubers are given for 8 sweet-potato varieties grown at Serdang. Samar Big Yellow (Bed 21) gave the highest yield of tops (72,745 lb./ac.) and Kang Kong 58 the highest yield of tubers (26,571 lb./ac.). These figures were obtained from unmanured crops whose tops were cut 6 times at 2-month intervals.—E.B.O.

1895 Nielsen, L. W. and Sasser, J. N. **Control of root-knot nematodes affecting Porto Rico sweetpotatoes.** *Phytopathology* 1959, **49**, No. 3, 135–40, bibl. 14. [N. Carolina Agric. Exp. Sta., Raleigh]

Plots on 3 soils infested with *Meloidogyne incognita acrita* were treated in mid-May with D-D (1,2-dichloropropane) at 5, 10 and 20 gal./ac., and EDB (1,2-dibromoethane) at 1·125, 2·25 and 4·5 gal./ac. in row applications with or without vermiculite as a carrier, and then planted with sweet-potatoes, var. Porto Rico, in early June. On sandy soil, emergence was reduced more by EDB than by D-D, but yields were not affected. On loamy soil, nematocides adsorbed on vermiculite reduced stands significantly more than did nematocides applied as liquid. On sandy and sandy loam soils, both nematocides, at high rates of application, gave considerable increases in yield of roots. On loamy soil, EDB at 4·5 gal./ac. was phytotoxic. The percentage of cracked roots was least at moderate rates of application on all soils.—R.B.

1896 Cordner, H. B. and others. **Carotene and ascorbic acid content in improved sweet potato variants.** *J. Agric. fd Chem.* 1959, **7**, No. 1, 53–4, bibl. 12. [Oklahoma State Univ., Stillwater]

This investigation shows the contents of carotene and ascorbic acid in the roots of present-day varieties of sweet-potato in relation to those found in about 240 clones under study. F. s.—E.B.O.

1897 Ezell, B. D. and others. **Relationship of Tristimulus colorimeter readings to carotenoid pigments in sweet potatoes.** *J. agric. fd Chem.* 1959, **7**, No. 1, 44–7, bibl. 15. [U.S. Dep. Agric., Beltsville]

Changes in the content of carotenoids (pigments which determine flesh colour) have been found to be a sensitive index of the response of sweet-potatoes to various growing and storage conditions, but a rapid method for measuring these changes is needed. Coefficients of correlation between total carotenoids of sweet-potatoes, as determined chemically, and the values obtained with the Hunter meter were statistically highly significant, but were not sufficiently close to give assurance that even relatively large differences could be detected. F. s.—E.B.O.

YAMS

1898 Sawada, E. and others. **Studies on the formation of aerial tubers in Chinese yam. 2. On the aerial tuber formation in sterile culture of vine segments.** [Japanese] *J. hort. Assoc. Japan* 1958, **27**, No. 4, 241–4, bibl. 7, illus., English summary.

Sugar was essential for aerial-tuber formation in yams [*Dioscorea esculenta*]. The size of tubers increased in proportion to the concentration of sugar in the nutrient medium. The time taken for vines to produce tubers was independent of the sugar concentration but it decreased with the progressing maturity of the vines. F. Eng. s.—D.B.

COCOYAMS

1899 Moursi, M. A. and Tayel, M.A. **The distribution of the dry matter and starch in the corms of dasheen.** *Ann. Agric. Sci.* 1957, **2**, No. 2, 177–81, bibl. 2. [Dep. Pl. Prod., Faculty Agric., Ain Shams Univ., Cairo]

In large-sized corms of the Egyptian dasheen, *Colocasia antiquorum*, dry-matter content and starch increased from the rose end to the heel end and the distribution of starch followed that of the dry matter. The best sampling procedure (for root dry-matter) is to take a diagonal core.—C.L.S.

JERUSALEM ARTICHOKE

1900† Bachmann, L. Die Anbaueignung von Topinambur (*Helianthus tuberosus*) unter mitteldeutschen Verhältnissen. **[The suitability of Jerusalem artichoke (*H. tuberosus*) for cultivation in Central Germany.]** *Kühn. Arch.* 1957, **71**, No. 4, 502–41, bibl. 61, illus., Russian, English and French summaries. [Inst. Acker- u. PflBau, Univ. Halle-Wittenberg, E. Germany]

H. tuberosus var. Dornburger was cultivated at

7 centres in E. Germany, and yields were compared with those of other crops. The tuber yield of Jerusalem artichoke was lower than the tuber yield of potatoes or the root yield of sugar- and fodder-beet, and was highest when harvested in spring. The amount and distribution of rainfall had a greater influence than soil type on yield and starch content of tops and tubers, autumn rainfall being especially important. A higher total yield of tops and tubers was obtained when there were 2 cuts of tops (July and October) than 1 cut in October, but with the former, the yield of tubers was reduced. In regions with a short growing-period (e.g. Harz Mountains), a single autumn cut of tops is recommended. Jerusalem artichoke can be cultivated for 2 consecutive years, during the first concentrating management on tuber production for the following spring, and in the second, taking several cuts of tops [produced from the small tubers remaining in the ground] during the summer. By this method, total yields (tops and tubers) are maintained, and the crop fits better into a rotation system because the land can be ploughed in autumn for early sowing of the next crop in the following spring. Because of the vitality of *H. tuberosus*, it is recommended for cultivation where other fodder crops are liable to be attacked by diseases and pests.—D.B.

1901 SALUNKHE, D. K. **Physiological and biochemical effects of gamma radiation on tubers of Jerusalem artichoke.** *Bot. Gaz.* 1959, **120**, No. 3, 180–3, bibl. 5, illus. [Utah State Univ., Logan]

Tubers of Jerusalem artichoke (*Helianthus tuberosus*) were given (0, 1, 2, 4, 8, 10, 20, 40 and 60) $\times 10^6$ rep gamma radiation. Dosages greater than 2×10^6 rep caused softening and disintegration of the tubers. Dosages between 1×10^6 and 4×10^6 rep caused darkening of the epidermis and an increase in oxidative enzymatic activity in the tubers, both of which were directly correlated with the radiation dosage ; greater amounts of radiation diminished these effects, and tuber colour at dosages greater than 20×10^6 rep resembled that of the controls. The amount of reducing sugars and acidity present in treated tubers was directly correlated with radiation dosage, while that of inulin, crude fibre and pectic substances was inversely correlated with dosage. The inulin content of tubers irradiated at the highest rate was completely converted to fructose within 10 min. when heated to 176°F. in the presence of 1 *M* HCl. F. S.—R.B.

KALE

1902† PRYTHERCH, E. I. and others. **Kale trials, 1954-57.** *Exp. Husb.* 1959, No. 4, 18–27, bibl. 2.

Dry-matter and protein contents, yields, and leaf/stem ratio at 3 harvest periods (Oct./Nov., Dec./Jan., Feb./March) were determined in 4 kale varieties, viz. Green Marrowstem, Purple Marrowstem, Thousandhead, and Canson, all grown in 7 centres throughout Wales. The results are tabulated.—D.B.

FIBRE CROPS

COTTON

See also Abs. 1741, 1941, 1961, 1970, 2057, 2064, 2092.

1903 GOL'DBERG, G. [**The temperature regime of germinating seed of cotton, and sowing dates.**] *Hlopkovodstvo* (*Cott. Prod.*) 1959, **9**, No. 3, 20–4.

1904 BELOUSOV, M. and others. [**The effect of increasing the density of the stand and of root nutrition on cotton yield.**] [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1959, **9**, No. 4, 25–30. [Ak-Kavak Cent. Agrotech. Sta.]

1905 ŠARDAKOV, V. S. [**The water regime and determination of the irrigation dates for cotton.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 141–6, bibl. 35. [Agric. Inst., Acad. Sci. Uzbek SSR] [Received Aug., 1958]

See also Abs. 877.

1906† GARIN, K. S. [**Determination of irrigation dates by means of cell-sap concentration.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 157–63, bibl. 9. [Novočerkass Engineering/Improvement Inst.] [Received Aug., 1958]

See also Abs. 877.

1907 HUTCHINSON, Sir J. and others. **The planning of a large farm for the Namulonge Cotton Research Station in Uganda. The development of the farm and the planning of a crop rotation.** *Emp. Cott. Gr. Rev.* 1959, **36**, No. 2, 82–103, bibl. 20.

The history of the development of the Namulonge farm is briefly traced. By 1958 approximately 900 of the 2240 ac. of land had been cleared. The farming system now employed is described and the problems encountered are discussed. The system of strip farming on the true contour is modified to combine safety with straight-line operation of implements. The effects of minor deviations from the contour are compensated for by the use of tied ridges. A rotation of 3 years' arable crops, followed by a 3-yr. *Chloris gayana* ley grazed by cattle, was adopted for the main farming areas. The choice of arable crops is governed by the need for early sowing of cotton to exploit the

second rains to the full. Beans, groundnuts and early-maturing K8 maize have been used in rotation with cotton. The economic aspects of the system are discussed.—A.M.H.

1908† Malickiĭ, N. [**Preparation of the soil for cotton crops and agrotechnical measures for shabdar (*Trifolium resupinatum*) in rotations which include a green-manure crop.**] [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1959, **9**, No. 3, 10–14.

While autumn tillage for cotton crops is preferable to spring cultivations, the greater advantages of autumn compared with spring for such work are not generally recognized in regard to the ploughing-in of green manure crops. Tests at the Azerbaĭdžan Scientific Research Institute for Agriculture have shown that ploughing-in of green manure in spring is more beneficial than an autumn application of fertilizer ; after autumn fertilizer, the yield of the subsequent cotton crop was 4470 kg./ha. but after ploughing-in a crop of shabdar in the spring, the yield from the cotton was 5760 kg. Similar data have been obtained from several Tadžik experimental stations, and also from Fergana in Uzbek SSR. Experience has shown that ploughing-in the green manure should be done early in spring so that the cotton can be sown by 15–20 April and seedlings emerge by 1–5 May. Shabdar should be sown in early autumn and subsequently given fertilizer and irrigation. Details are supplied of sowing norms, rates of fertilizer and irrigation applications, machinery, cultivation measures employed on saline soils and seed production from different varieties of shabdar.—M.H.

1909 Dorman, I. [**Concerning the herbage/green-manure system of farming proposed by N. A. Malickiĭ.**] [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1959, **9**, No. 4, 9–13.

See also Abs. 1908.

1910† Romanovskiĭ, B. and Topušseva, N. [**Experiments with sowing shabdar (*Trifolium resupinatum*) as a green manure under cotton.**] [Russian] *Hlopkovodstvo* (*Cott. Prod.*) 1959, **9**, No. 3, 24–7.

See also Abs. 1908.

1911 Moosberg, C. A. and Waddle, B. A. **Rex cotton . . . a progress report.** *Ark. Fm Res.* 1958, **7**, No. 6, 9.

The results are given of comparative trials with Rex, Deltapine 15 and Stoneville 7 at 3 locations. Rex is a new, early-maturing variety with resistance to angular leaf-spot and tolerance to Fusarium wilt.—J.D.J.

1912 Fryxell, P. A. and others. **Performance of some wide crosses in Gossypium.** *Bull. 419 New Mexico Agric. Exp. Sta.* 1958, pp. 15, bibl. 5.

A hybrid of Pima 32 (*Gossypium barbadense*) × Acala 1517C (*G. hirsutum*) yielded 965 lb. lint/ac. and appeared to be well adapted for commercial production.—R.B.

1913 Clinton, P. K. S. **Effects of dressings with fungicides and insecticides on American cotton in the Sudan Central rainlands.** *Emp. J. exp. Agric.* 1959, **27**, No. 106, 124–32, bibl. 4. [Cent. Rainlands Res. Sta., Sudan]

With the American cotton variety BAR 7/8.1, fungicidal seed dressings were not necessary to control blackarm disease (*Xanthomonas malvacearum*), but their use, and that of seed dressings containing γ-BHC and dieldrin, prevented the normally heavy losses in plant population. In the one case where the use of dieldrin increased yields, initial plant populations were low. Applying insecticides as soil dressings was not advantageous. F. s.—A.M.H.

1914 Amin, J. V. and Joham, H. E. **Molybdenum in the cotton embryo.** *Soil Sci.* 1958, **86**, No. 6, 293–7, bibl. 4. [Texas Agric. Exp. Sta., College Station]

1915 Bradford, W. W. and Ewing, E. C. **Preliminary studies on the application of gibberellic acid to cotton seed and seedlings.** *Agron. J.* 1958, **50**, No. 11, 648–50, bibl. 10, illus. [Res. Dep., Delta and Pine Land Co., Scott, Miss.]

In sowings made in July 1957 significant reductions in stand and significant increases in seedling height, and length and width of cotyledons, occurred following soaking of Deltapine cotton seed in aqueous solutions of 50, 100 or 200 ppm. GA for 24 hr. or for 30 min. before sowing, or after spraying with 100, 500 or 1000 ppm. GA in aqueous solution. Spraying newly-emerged cotton seedlings with 25, 50, 100, 200 or 500 ppm. aqueous GA solution sufficient to wet the seedlings increased seedling height, length and width of cotyledons, and length of first internode, but decreased the length and width of second leaves. Cotton seed of 54 and 81% germination treated with dusts containing 10, 25, 50, 100, 1000 and 10,000 ppm. GA and sown in April 1958 showed no improvement in seedling emergence or survival. The stems of seedlings treated with GA were finer, and lodging occurred more readily, than in untreated controls. F. s.—R.B.

1916 Mei-Hsiang, K. and Cheng, T. **The effect of copper on the growth and drought resistance of cotton seedlings.** [Chinese] *Acta bot. sinica* 1957, **6**, No. 1, 73–9, bibl. 7, illus., English summary. [Shan-si Normal Coll. and Nan-Kai Univ.] [Received July, 1959]

Treatment of cotton seeds with $CuSO_4$ solution improved growth of shoots and roots by improving the water relations of the seedlings. The response to different concentrations of $CuSO_4$ varied according to the variety and the conditions (field or greenhouse) under which it was grown. Seed-treatment with $CuSO_4$ may be used to improve germination and early growth of cotton in N. China which experiences severe spring droughts. F. Eng. s.—D.B.

1917 Lo-Ping, T. **A preliminary report of the influence of BHC on the morphology, physiology and yield of the cotton plants.** [Chinese] *Acta Agric. sinica* 1958, **9**, No. 4, 340–56, bibl. 14, illus., English summary. [Chien-yang Agric. Exp. Sta., Szechuan, China]

Injuries to leaves, buds, flowers, bolls and meristems of cotton plants after treatment with 4 formulations of BHC are described. An emulsion prepared in the laboratory from 81% γ-isomer produced less injury than commercial formulations. The experiments show the need for the production of a purer γ-isomer in China. F. Eng. s.—D.B.

1918 Leinweber, C. L. and Hall, W. C. **Foliar abscission in cotton. 1. Effect of age and defoliants on the respiratory rate of blade, petiole, and tissues of the abscission zone.** *Bot. Gaz.* 1959, **120**, No. 3, 144–51, bibl. 10, illus. [Fld Crops Res. Br., Agric. Res. Serv., USDA, Stillwater, Okla]

Respiratory measurements were made on Deltapine 15 cotton leaf tissues from untreated plants and from plants treated with 1% solutions of $NaClO_3$/Na metaborate, Na_2CN_2, PCP, Na ethyl xanthate, amitrol and endothal in glasshouse and field tests. PCP and Na ethyl xanthate produced leaf desiccation, the other treatments defoliation. Leaf blade, petiole and pulvinoid tissues had different rates of respiration, and the effect of defoliants on these rates depended on the tissue concerned, the defoliant used, and the time after treatment. The respiration rate of untreated leaf tissues was influenced to a great extent by the physiological age of the leaf ; it decreased with age in leaf blade tissue and increased with age in pulvinoid tissue, especially in the abscission zone where the maximum rate occurred at leaf abscission. In sprayed field plots sampled every 12 hr., endothal was shown to stimulate respiration in the abscission zone and to hasten events leading to natural abscission. Amitrol inhibited respiration at first in the abscission zone of all leaves except those not fully expanded. Leaf fall was more rapid from plants treated with amitrol than from those treated with endothal, and was not related to the physiological age of the abscission zone.—R.B.

1919 Leinweber, C. L. and Hall, W. C. **Foliar abscission in cotton. 2. Influence of age and defoliants on chemical composition of blades and pulvinoids.** *Bot. Gaz.* 1959, **120**, No. 3, 183–6, bibl. 9. [Fld Crops Res. Br., Agric. Res. Serv., USDA, Stillwater, Okla]

Deltapine 15 cotton plants were treated with amitrol or endothal at 9 a.m. ; leaf samples were collected 0, 1, 4 and 10 hr. after treatment, and also from untreated controls. [See previous Abs.] The content of Mg, K, Ca and P in the leaf blades remained relatively constant throughout the sampling period ; cations accumulated gradually with increasing age of leaf, but the amount of P declined in chlorotic, partly abscissed leaves. The content of total N and soluble N in the leaf blades decreased, and that of soluble N in the pulvinoids increased, as the leaves aged. Both treatments depressed the content of total sugars in the leaves ; amitrol did so more rapidly and to a greater extent than endothal. Endothal, but not amitrol, increased leaf starch content and decreased leaf hemicellulose content.—R.B.

1920 Brisley, H. R. and others. **Sulphur dioxide fumigation of cotton with special reference to its effect on yield.** *Agron. J.* 1959, **51**, No. 2, 77–80, bibl. 8, illus. [Phelps Dodge Corp., Douglas, Arizona]

There was a linear relationship between the area of foliage destroyed by SO_2 fumigation of cotton plants and the resulting crop yield. There was no decrease in yield in the absence of visible symptoms of injury. The loss in yield due to fumigation was a function of the number of bolls produced ; treatment had no effect on the development of bolls or the weight of seed cotton per boll. There was no shedding of involucres as a result of fumigation. There was no yield loss resulting from fumigation after 14 Sept., because blooms developing after this date did not produce cotton.—A.M.H.

1921 Wahhab, A. and Ahmad, R. **Manuring of cotton in West Pakistan. 1. Effect of the preceding crop on the yield of seed cotton.** *Emp. J. exp. Agric.* 1959, **27**, No. 106, 117–23, bibl. 11. [Agric. Coll., Lyallpur, Pakistan]

Cotton was sown after gram [*Cicer arietinum*] grown with or without superphosphate, Egyptian clover [*Trifolium alexandrinum*] grown with or without superphosphate, toria (*Brassica campestris*), wheat, wheat following guar (*Cyamopsis psoraloides*) as green manure, or winter fallow, at 5 different localities. Cotton after fallow or legumes gave the best results. The most economic rotation was cotton following Egyptian clover receiving superphosphate at 50 lb. P_2O_5/ac. The same rotation without superphosphate was the next best. F. s.—A.M.H.

1922 Miller, P. A. and others. **Variety x environment interactions in cotton**

variety tests and their implications on testing methods. *Agron. J.* 1959, **51**, No. 3, 132–4, bibl. 7. [N. Carolina Agric. Exp. Sta., Raleigh]

Fifteen cotton varieties were grown at 9 locations in N. Carolina for 3 yr. and lint yield, lint percentage, weight per boll, fibre length, fibre strength and fibre fineness were recorded. Variety × location and variety × year interactions were small and not significant. The second-order interaction variety × location × year was highly significant, except in the case of fibre fineness. Second-order interactions tended to be small in comparison with the variance due to varieties, except in the case of lint yield. The lack of substantial interaction between varieties and locations indicated that little advantage would be gained by dividing N. Carolina into sub-areas for experimental work on cotton.—R.B.

FIBRE FLAX

See also Abs. 1968, 2014, 2057.

1923 FRIEDERICH, J. C. Hoe teelt men kwaliteitsvlas ? [**How is high quality fibre-flax grown** ?] *Meded. 21 Proefst. Akker- en Weidebouw* 1959, pp. 14, bibl. 4.

Recommendations concerning crop rotations, soil preparation, varieties, dates of sowing, seed rates, seed disinfection, method of sowing, undersown crops, fertilization, disease, insect and weed control, and harvesting under Netherlands conditions are given.—R.B.

1924 FRIEDERICH, J. C. Le rôle de la plante sous-abri dans la culture du lin textile. [**The influence of an undersown crop on fibre flax.**] *Fibra* 1959, **4**, No. 1, 9–11, English summary.

In the Netherlands legumes are undersown in fibre flax for the production of fodder or green manure, but this practice, especially if red clover or lucerne is used, lowers the quantity and the quality of the fibre. During the past few years, the practice has been increasing of undersowing slow-growing grasses for seed production (*Poa pratensis*, *Festuca rubra*, *F. pratensis* and *Phleum pratense*) which are harmless to flax. To reduce the damage caused by undersown legumes, it is recommended that white clover or *Medicago lupulina* be used instead of red clover or lucerne. If red clover or lucerne, which yield considerably more than the former legumes, is used, it should be sown 15 days after flax. Weed control in flax by preparations based on the Na salt of DNOC causes damage to lucerne and, more so, to *M. lupulina*.—E.B.O.

1925 FRIEDERICH, J. C. Resultaten betreffende de toepassing van enkele nieuwe herbiciden in vezelvlas. [**The application of some new herbicides in fibre-flax.**] *Meded. LandbHogesch. Gent* 1958, **23**, Nos. 3 and 4, 944–9.

In high-volume spraying trials, Na-dinoseb, with or without MCPA, killed more weeds in fibre-flax than MCPA alone. Early applications of NaDNC, with or without MCPA, gave satisfactory weed control ; 40% MCPB at less than 3 l./ha. was unsatisfactory. With dinoseb, temperatures lower than 15°C. and relative humidities lower than 65% reduced the amount of weed control, while temperatures above 20°C. and relative humidities above 85% increased the likelihood of crop damage. Under cool, dry conditions, 30% MCPA at 1–2 l./ha., Na-dinoseb at 5 l./ha., and MCPA + dinoseb at 6 l./ha. had a slight, and 40% MCPB at 3 l./ha. a considerable, adverse effect on the quality and percentage of long fibres in the crop, while MCPA + NaDNC at 8 l./ha. had no adverse effect. Na-dinoseb and NaDNC damaged undersown red clover and black medick [*Medicago lupulina*] more than did other herbicides. An alkanolamine ester of dinoseb at 10 l./ha. caused serious leaf burn, while at 6 l./ha. it gave excellent weed control with little crop damage.—R.B.

1926 FREDERIKSEN, P. S. Kemisk ukrudtsbekæmpelse i spindhør 3. Særligt med henblik pa virkningen af dinoseb. [**Chemical weed control in fibre flax. 3. With particular reference to the effect of dinoseb.**] *Lin* 1958 **12**, No. 6, 75–80. [Dansk HørforskInst., Holbergsvej 6, Kolding, Denmark]

The results are given of 2 series of trials carried out during 1950–6. In both series, the fibre-flax varieties Wiera and Concurrent were used and the plants were 4–6 cm. high when treated. In the first series of 5 trials during 1950–1, the following treatments were applied per ha. : (a) 30 kg. $CuSO_4$, (b) 0·75 kg. NH_4 dinoseb, (c) 2·5 kg. Na DNC, (d) 1·25 kg. NH_4 DNC, (e) 1·25 kg. Na DNC + 0·5 kg. Na MCPA, and (f) 0·5 kg. Na MCPA. All herbicides were applied in 1000 l. spray volume. Treatments (c) and (e) resulted in highly significant increases in the yield of deseeded straw, compared with untreated controls, the respective yield increases being 508 and 593 kg./ha. Dinoseb was considerably less effective than treatments (c) and (e). In the second series of 9 trials during 1952–6, the following treatments were applied per ha. : (1) 0·8 kg. NH_4 dinoseb, (2) 0·6 kg. NH_4 dinoseb, (3) 0·4 kg. NH_4 dinoseb, (4) 0·2 kg. NH_4 dinoseb, (5) 0·2 kg. dinoseb + 0·5 kg. MCPA, (6) 0·4 kg. NH_4 dinoseb + 0·25 kg. MCPA. In all cases except (1), in which 800 l. were used, the herbicides were applied in 300 l. spray. Only treatment (a) resulted in a significant increase in yield of deseeded straw, compared with untreated controls. It was concluded that where dinoseb was used, it should be applied in amounts of 0·5–0·8 kg. active material/ha. in a high spray-volume and at low spray-

pressure. High spray-pressures resulted in crop injury. Dinoseb tended to be variable in effect and less reliable than MCPA or DNC or mixtures of these herbicides. [See also *Fld Crop Abstr.* 11 : 1186.] —P.J.B.

1927 ANSELME, C. Étude comparative de différents produits utilisés pour la désinfection des semences de lin. [**Comparative study of various preparations used for disinfecting flax seeds.**] *Phytiat.-Phytopharm.* 1958, **7**, 3–13, bibl. 30. [Sta. Cent. Path. Vég., Versailles, France]

The results from the trials described showed that organo-mercury preparations used for disinfecting fibre-flax seeds can be phytotoxic (as shown by a reduction in the size of the plants), especially if the treated seeds are stored for several months before sowing. This toxic effect can arise from : (a) using a high rate of the fungicide ; (b) treating seeds with a moisture content higher than 12–13% ; (d) bad storage (lack of aeration, high temperature). If the seed is to be stored for several months, it is preferable to treat it with tetramethyl thiurame disulphide or with an organo-mercury preparation at a reduced rate (20% less than normal).—E.B.O.

1928 BONNEMAISON, L. and BOURNIER, A. Note préliminaire sur les thrips nuisibles au lin. [**Preliminary note on thrips harmful to flax.**] *C.R. Acad. Agric. Fr.* 1958, **44**, No. 16, 828–31, bibl. 2. [Sta. Cent. Zool. Agric., Montpellier, France]

During the past few years, flax crops in northern and western France have been attacked by thrips, mainly *Thrips lini* and *T. angusticeps*, with resulting reductions in the quantity and quality of the fibre. Control measures, including cultural methods, seed treatment, and spraying and dusting the crops, are suggested. Seed treatment consists in dressing the seed with gas-oil or castor-oil to ensure adhesion of the insecticide which is applied 24 hr. later. Thimet applied at the rate of 170 or 340 g. active principle per 100 kg. of seed, disyston at 200–800 g.a.p., lindane at 300 g.a.p. and heptachlor at 80 g.a.p., slightly delayed emergence but did not reduce the germination percentage. In trials with crop sprays, the most effective treatments were in g.a.p./ha. ; dieldrin 300, diazinon 200, parathion 300 and lindane 300.—E.B.O.

1929 FREDERIKSEN, P. S. Aktuelle hørproblemer. Thrips og thripsbekæmpelse. [**Current fibre-flax problems. Thrips and thrips control.**] *Lin* 1958, **12**, No. 4, 45–7.

Thrips (*Thrips angusticeps*) damage to fibre flax is normally worst after preceding crops of barley or crucifers and attacks usually start in mid-June when the fibre flax is 30–50 cm. high. It is recommended that, where possible, fibre-flax should be grown after a preceding crop of oats and that where grown after barley, active measures to control thrips should be taken. At the first sign of thrips damage, treatment with parathion is recommended, though such treatments should not be applied within one week before or after applying herbicides.—P.J.B.

KENAF

1930 CHUAN-MIN, S. and YU-WEN, L. **Studies on the control of kenaf anthracnose (*Colletotrichum hibisci* Pollacci).** [Chinese] *Acta phytopath. sinica* 1958, **4**, No. 1, 25–55, bibl. 10, English summary.

C. hibisci develops on *Hibiscus cannabinus* in rainy seasons but not in regions of light rainfall where the crop is cultivated under irrigation. While the N. China varieties, e.g. Tashgan and Xuaneng No. 1, are very susceptible to the disease, Madras Red from S. China, when cultivated in N. China, is resistant but does not produce seed. Thirty-three [resistant] varieties have been developed by selection from Madras Red and these ripen their seed in N. China, where they are being released for cultivation. F. Eng. s.—D.B.

OIL CROPS

SESAME

1931 HATANAKA, SHIN-ICHI. **Oligosaccharides in the seeds of *Sesamum indicum* L.** *Arch. Biochem.* 1959, **82**, No. 1, 188–94, bibl. 21. [Bot. Inst., Univ. Tokyo, Hongo]

A trisaccharide, isolated from seeds of *S. indicum*, was identified as planteose. The tetrasaccharide fraction obtained was probably a mixture of lychnose and a new isomer of it, for which the name sesamose is proposed. F. s.—E.B.O.

1932 CHAKRAVARTI, S. C. **Some effects of gibberellic acid on *Sesamum indicum* L.** *Phyton* 1958, **11**, No. 1, 75–83, bibl. 23. [Dep. Bot., Hamidia Coll., Bhopal, India]

In this investigation to determine the effect of GA on the extension growth, elongation of the internodes and number of pods in *Sesamum indicum*, aqueous solutions of GA at 1, 10 and 100 ppm. were applied as foliar sprays, once or several times, starting when the plants were 10 or 24 days old. High concentrations of GA changed the shape of leaves from ovate to lanceolate, and also their arrangement, in the vegetative region, from the opposite to the alternate position. Most treatments resulted in an elongation of the internode growing at the time of treatment, the degree of which was directly proportional to the concentration applied. The internodes which formed after the cessation of treatment were shorter than the

corresponding internodes of untreated plants. A significant increase in the number of pods was observed in plants treated with small concentrations of GA at an early stage, but treatment with high concentrations decreased the number of pods. —E.B.O.

OIL-SEED FLAX

1933 Liró, O. L. La linaza. Cultivo del lino para grano. [**The growing of oil-seed flax (in Spain).**] *Hojas divulg. 3-59 H Minist. Agric. Spain* 1959, pp. 20, illus.

1934 Singh, D. and Gangwar, L. C. **T.126, an improved variety of linseed for north-eastern districts of Uttar Pradesh.** *Indian Oilseeds J.* 1958, **2**, No. 4, 87–8.

T.126, a new, rust-resistant variety of *Linum usitatissimum* has been selected for the alluvial flax-growing regions of Uttar Pradesh. Medium in height, it branches from the upper part of the stem, has a purplish flower and matures early (140–145 days). The seed is brown and bold (102 seeds per gram compared with 175 per gram of local varieties). The [seed] yield averages 800 lb. per acre (with a range between 384 and 1584 lb. per acre) and the oil content is 41·4%. The [seed] yield was about 40% above that of local varieties and 10% above the previously recommended T.477.—D.B.

POPPY

1935 Endrizzi, L. Il papavero non da oppio. [**Poppy, not grown for opium.**] *G. Agric. Domen.* 1959, **69**, No. 16, 151, illus.

Poppy [*Papaver* sp.] is grown for seed (for human consumption) to a limited extent in the mountain areas of Bolzano province, Italy. Its vegetative period is 150–180 days. The seed is sown early in spring in rows 30 cm. apart at a depth of 0·5–1 cm., at a rate of 4–5 kg./ha. After 5–6 weeks from germination, the plants are thinned, leaving 15–20 cm. between plants in the row. The plants are cut when completely mature and are then air-dried. The seed yield is 1000–1800 kg./ha., exceptionally 3000 kg. or more. The oil content in the seed can be as much as 50% by weight.—E.B.O.

MUSTARD

1936 Sen, P. K. and Sarkar, A. K. **Studies on nutrition of oil-seed crops. 2. Effect of phosphorus on growth, yield and oil content of mustard (*Brassica juncea* Hook F. and Thoms.).** *Indian Agric.* 1958, **2**, No. 2, 113–19, bibl. 11. [Calcutta Univ.]

OIL CROPS—GENERAL

1937 Kulkarni, L. G. **Oilseed crops in Andhra Pradesh.** *Indian Oilseeds J.* 1958, **2**, No. 4, 65–8, bibl. 5.

CROP BOTANY

PHYSIOLOGY

1938† Kunar, I. I. and others. [**Rhythms of the absorptive and excretory activities of roots.**] [Russian] *Izv. Timirjazevsk. S.-H. Akad. (Bull. Timirjazev agric. Acad.)* 1959, No. 1 (26), 15–34, bibl. 35, English summary.

The plants studied included varieties of *Phaseolus* sp., *Helianthus annuus*, *Glycine soja* and *Avena sativa*.—M.H.

1939† Medvedev, Z. A. **Modern conceptions of protein synthesis in plants.** [Russian] *Izv. Timirjazevsk. S.-H. Akad. (Bull. Timirjazev agric. Acad.)* 1959, No. 2 (27), 57–74, bibl. 85, English summary.

This is a review of papers published during the period 1939–58 in the USSR, other European countries and the USA.—M.H.

1940† Wit, C. T. de. **Potential photosynthesis of crop surfaces.** *Neth. J. agric. Sci.* 1959, **7**, No. 2, 141–9, bibl. 10. [Inst. Biol. Scheik. Onderz. LandbGew., Wageningen, Netherlands]

A formula for calculating the potential photosynthesis of a closed crop surface is proposed, assuming that the leaves of the crop are not arranged in any definite direction. In the Netherlands, values for potential photosynthesis vary from 290 kg. CH_2O/ha./day in June to 50 kg./ha./day in December. F.S.—R.B.

1941 Koval'skaja, E. M. [**Variation of salt-resistance in plants during ontogenesis.**] [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1958, **5**, No. 5, 434–44, bibl. 34. [Timirjazev Inst. Pl. Physiol., Moscow]

Part of this work concerns tests made with *Gossypium* sp. var. 1298. The plants were grown in vessels containing 8 kg. argillaceous turf soil, with moisture maintained at 70% of the water-holding capacity. Sodium chloride (in 0·05% concentration) was added to the vessels by two methods, namely in one dose (at the early growth stage, at

budding, or at flowering), or gradually, in small doses, during 10 days of growth. There is indication that salt resistance of the plants depends on growth stage and method of applying the salt. When added at the early growth stage, the number of bolls was 20% lower than that of the control. When the salt was added gradually during early growth, no toxic effect was observed, but when given at the budding stage, boll formation was lowered by 64% compared with the control. The plants are most sensitive to unfavourable conditions when at the flowering stage, but if the salt is added to the medium gradually, there is little apparent detrimental effect. There is discussion of the colloidal/chemical complex of protoplasm in relation to the plant's resistance to salinity.—M.H.

GROWTH AND REPRODUCTION

See also Abs. 2083.

1942† Mehta, B. V. and Desai, R. S. **Effect of soil salinity on germination of some seeds.** *J. Soil Wat. Conserv. India* 1958, **6**, No. 1, 169–76, bibl. 14. [Inst. Agric., Amand]

In a fine loam sandy soil, the effect was studied of NaCl and $CaCl_2$ at 8 salinity levels (0 rising by 0·25 to 2·5% of soil solution at field capacity) on germination of seed of 8 crop species which included *Cyamopsis psoraloides*, *Pennisetum typhoideum*, *Gossypium herbaceum* and *Dolichos lablab*. Results are tabulated. Salt tolerance in species decreased in the above order.—D.B.

1943 Yu-Ching, W. **The influence of *Azotobacter chroococcum* on the germination of seeds.** [Chinese] *Acta Agric. sinica* 1958, **9**, No. 3, 277–83, bibl. 9, English summary.

Various suspensions of *Azotobacter* increased seed germination of wheat, rice and maize. The cell-free filtrate and an unfiltered suspension were even more favourable to germination. F. Eng. s.—D.B.

1944† Mayer, A. M. **Helping seeds to germinate.** *New Scient.* 1959, **5**, No. 130, 1083–5. [Bot. Dep., Hebrew Univ., Jerusalem, Israel]

Increasing knowledge of methods by which Man can stimulate seed germination assists the introduction of new crops. F. s.—C.L.S.

1945 Bennet-Clark, T. A. and others. **Geotropic behaviour of roots.** *J. exp. Bot.* 1959, **10**, No. 28, 69–86, bibl. 14, illus. [King's Coll., London]

The results of experiments with *Sinapis alba*, *Vicia faba* var. Windsor and *Pisum sativum* var. Meteor are discussed with reference to the importance of haptotropic as well as geotropic stimulation in bringing about curvature of roots growing in soil and other media. The hypothesis of new production of growth substances, or possibly their release from vacuoles, is considered more consistent with the experimental data than the earlier one of the redistribution of auxin already present. Growth substances thought to be involved in the response were studied using starch column chromatography.—A.M.H.

1946† Borrill, M. **Inflorescence initiation and leaf size in some Gramineae.** *Ann. Bot., Lond.* 1959, **23**, No. 90, 217–27, bibl. 6. [Welsh Pl. Breed. Sta., Aberystwyth]

The morphology of successive leaves on the flowering shoot was studied in species of *Glyceria*, *Lolium* and *Triticum*. A correlated change occurs in blade morphology associated with the onset of the reproductive state of the shoot apex, brought about by changes in the amount of cell extension. A study of the effect of different amounts of low temperature and different daylengths on the relation between inflorescence initiation and the production of the longest leaf blade showed that, under some conditions, this relationship can be disturbed. F. s.—M.H.

1947 Hendricks, S. B. **Photoperiodism.** *Agron. J.* 1958, **50**, No. 12, 724–9, bibl. 11, illus. [USDA, Beltsville, Maryland]

The effects of light on the growth and flowering of barley, wheat, maize, peas, soyabeans and various other plants are discussed.—R.B.

1948 Domańska, H. Wzrost i rozwój rzepaku jarego w zalenżności od wilgotności gleby. **Growth and development of spring rape as depending upon the soil moisture content.** *Roczn. Nauk rol.* 1958, **78**, Ser. A, No. 4, 579–619, bibl. 49, illus., Russian and English summaries.

1949 Highkin, H. R. **Temperature-induced variability in peas.** *Amer. J. Bot.* 1958, **45**, No. 8, 626–31, bibl. 6, illus. [California Inst. Technol., Pasadena]

Peas of the varieties Unica and L5 were grown either in constant-temperature chambers at 10, 17 or 20°C., with artificial light of 1000 f.c. intensity for 16 hr./day, or in glasshouses at day temperatures of 17, 20 and 23°C. and corresponding night temperatures of 11, 14 and 17°C. with natural daylight supplemented by low-intensity artificial light up to a total of 16 hr./day. Growth-rate measurements on peas grown at constant temperatures revealed a steady decrease in vigour in successive generations; seeds from the 6th generation were practically non-viable. Plant vigour returned when seedlings were transferred to conditions of fluctuating temperature, but 3 generations were required for vigour to return completely. When these plants were again returned to constant temperature conditions, plant vigour was proportional to the number of generations spent under fluctuating conditions. Plants from

differing conditions of fluctuating temperature showed differing growth responses when transferred to constant temperature conditions.—R.B.

GROWTH SUBSTANCES

See also Abs. 2091.

1950† Stowe, B. B. and Yamaki, T. **Gibberellins: stimulants of plant growth.** *Science* 1959, **129**, No. 3352, 807–16, bibl. 155, illus.

This is a review article.—R.B.

1951 Leh, H.-O. Versuche über die Wirkung von Gibberellinsäure auf einige Kulturpflanzen. [**The action of gibberellic acid on some crop plants.**] *Z. PflErnähr.* 1958, **83**, No. 3, 234–44, bibl. 51, illus. [Techn. Univ., Berlin]

Supplements of GA, in amounts up to 10 ppm. of nutrient solution, increased the fresh- and dry-weight of tops of *Pisum sativum*, *Avena sativa* and *Zea mays*, among other plants. In *P. sativum*, shoot internodes lengthened with concentrations up to 100 ppm. GA, and flowering was inhibited with 1·0 ppm. In oats, the leaf sheath lengthened as concentrations increased to 100 ppm. GA. Maize exhibited leaf deformation. The strength of the shoots of these species and their root growth were weakened with increasing GA concentrations. The elongation is a result both of water retention by the plant and an increase in plant material. It is thought that the elongation is caused by GA acting on the hormone balance.—D.B.

1952 Chouard, P. and Lourtioux, A. Contribution à l'étude des réactions de croissance des pois nains sous l'action combinée de la gibbérelline et d'auxines et d'anti-auxines. [**Contribution to the study of reactions in the growth of dwarf peas under the joint effect of gibberellin, auxins and anti-auxins.**] *Bull. Soc. franç. Physiol. vég.* 1958, **4**, No. 3, 98–100. [Physiol. Vég., Sorbonne, Paris]

The results are given of preliminary glasshouse trials with dwarf peas in 1958.—E.B.O.

1953† Mitrović, A. and Pavličić, J. Primena giberelina na kulturne biljke. Dejstvo giberelina na porast i razviće soje i lespedezo. [**The application of gibberellin on cultivated plants. The effect of gibberellin on the growth and development of soyabean and lespedeza.**] *Arhiv. polj. nauke* 1959 **12**, No. 35, 22–34, bibl. 8, English summary.

The experiment was made in a glasshouse with *Glycine soja* var. Hawkeye and *Lespedeza stipulacea*. Single, double and triple applications of foliar sprays were compared when the aqueous solution of gibberellin was supplied at 100 and 10 ppm., and at 1000 ppm. on to the stem apices (by means of a micropipette), at specified stages of plant growth. The triple spraying by which each plant received 0·4 ml. of the solution (100 ppm. concentration) at the 1- to 3-, or 3- to 5-leaf stage proved best for both plants, increasing the plant height and the number of leaves, nodes and branches. F.S.—M.H.

1954 Wheeler, A. W. **Biological assay of leaf growth-substances.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 77–8.

Both gibberellic acid (GA) and kinetin (K) were active at 10^{-5} and 10^{-6}M in the wheat-coleoptile-section and etiolated-pea-section tests used for IAA and related auxins. To measure the activity of GA and K in promoting leaf expansion, 6-mm. discs of dwarf-bean leaves were floated on the test solution containing 1% sucrose and the increase in diameter of the discs was measured after 24 hr. in darkness at 25°C. This confirmed that both GA and K accelerate leaf expansion. The effect of K was eliminated in light, but that of GA was slightly increased. The GA test was more sensitive when plants from small seeds were used than with those from large seeds.—A.M.H.

1955† Osborne, Daphne J. **Identity of the abscission-accelerating substance in senescent leaves.** *Nature, Lond.* 1959, **183**, No. 4675, 1593, bibl. 3. [Unit Exp. Agron., Dep. Agric., Oxford]

1956 Förster, K. Wachstumsreaktionen an Wurzelhaaren. [**Growth reactions of root hairs.**] *Flora, Jena* 1958, **146**, No. 1/2, 1–22, bibl. 34, illus. [Berlin NO 55, Hufelandstrasse 24, Germany]

The effect of the antibiotic xanthozillin in soluble form (e.g. the disodium salt), in concentrations of the order of 10 mg./l., suppressed the development of root hairs in *Avena* spp., *Datura* spp., *Linum usitatissimum*, *Sinapis alba*, *Phaseolus vulgaris*, *Fagopyrum esculentum* and *F. tataricum* (among other plants). In the *Fagopyrum* species, the root hairs were greatly reduced in number and in length. In some other species they were absent. At lower concentrations of xanthozillin (5 and 1 mg./l.), root hairs grew more normally, but at no dilution was there a growth-stimulating action. Root epidermal cells were uninjured. The action of xanthozillin was not transmitted to other parts of the plants.—D.B.

NUTRITION

See also Abs. 2084.

1957 Schütte, K. H. and Martin, P. **The influence of certain micro-nutrient deficiencies on the germination rates of radish and millet.** *Plant and Soil* 1959, **10**, No. 3, 299–302, bibl. 1. [Bot. Dep., Univ. Capetown, S. Africa]

Seeds of millet (*Pennisetum glaucum*) were soaked for 12 hr. in different culture solutions deficient in B, Cu, Mn or Zn, respectively, before being germinated in sand or on filter paper at 15, 20, 25 and 30°C. The rate of appearance of shoots above the sand, and the rate of sprouting and shoot growth on filter paper, were more rapid in seed treated with the nutrient-deficient solutions than in controls treated with a complete nutrient solution, though the degree of significance of the results differed between the 3 methods. No treatment significantly altered the final percentage germination.—R.B.

1958† WHITTINGTON, W. J. **The role of boron in plant growth. 2. The effect on growth of the radicle.** *J. exp. Bot.* 1959, **10**, No. 28, 93–103, bibl. 20. [Sch. Agric., Univ. Nottingham]

Estimates of cell number, cell volume, respiratory rate, and content of N, sugar and nucleic acid were made on 1-mm. sections of the radicles of field bean at frequent intervals during the first 96 hr. of growth in nutrient solutions with and without B. The primary effects of B deficiency were cessation of cell division and enlargement of the apical cells. The increased volume of the apical cells may have been due either to a longer period being available for development as the rate of mitosis decreased, or to an unusually rapid rate of cell extension. The results indicated that cell division did not cease for lack of available sugar nor as a result of failure to synthesize protein or nucleic acids. It is suggested that in the absence of B, division ceases because abnormalities in the formation of the cell wall prevent the cell from becoming organized for mitosis. In particular the hypothesis that B is concerned with the formation of " pectin " from uridinediphosphate-D-glucose is examined in the light of published evidence. F. s.—A.M.H.

1959† HEINTZE, Signe G. **Cation-exchange capacity of plant roots.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 58.

The cation-exchange capacities of washed roots were determined by 3 methods. The values obtained were generally similar to published results, e.g. 2-year-old lucerne, 1–7 millequivalents/100 g. dry root ; peas grown in pots, 75 m.e.q. ; perennial and Italian ryegrass, cocksfoot and timothy, 20–28 m.e.q. ; wheat and barley, 12–16 m.e.q. Red clover gave lower results than usual (13–16 m.e.q. instead of 40–50). There was little change in cation-exchange capacity of wheat roots during spring and summer ; with kale and clover values decreased as the season advanced. N fertilizer increased the exchange capacities of newly sown Italian ryegrass in the field and of barley in sand culture. Values for wheat and permanent grass were not affected by N.—A.M.H.

1960 HUFFAKER, R. C. and WALLACE, A. **Variation in root cation exchange capacity within plant species.** *Agron. J.* 1959, **51**, No. 2, 120. [Dep. Hort. Sci., Univ. California, Los Angeles]

In soyabeans, the root cation-exchange capacity (CEC) increased with increasing $H_2PO_4^-$ supply and was greater in the presence of NO_3^- than NH_4^+. It was also greater in plants with lime-induced chlorosis than in non-chlorotic plants. In both maize and soyabeans the CEC was slightly higher at 1 me. NO_3^- /l. than at 20 me./l. The values obtained were independent of root size.—A.M.H.

1961 VAN SCHOOR, Germaine H. J. Nouveaux développements sur les relations entre la composition élémentaire du milieu extérieur et celle de la plante (*Gossypium hirsutum* L.). [**New developments in the relationship between the composition of the environment and that of the plant** (*G. hirsutum*).] *Ann. Physiol. vég., Univ. Brux.* 1958, **3**, No. 2, 47–182, bibl. in text.

The relationship between the composition of the nutrient solution and that of the plant was studied in *Gossypium hirsutum* plants grown in pots. Determinations were made of NO_3, SO_4, PO_4, K, Ca and Mg in leaves and fragments of stems. It is concluded that both anion- and cation-content vary under the influence of the nutrient solution, but the latter to a much greater extent than the former.—E.B.O.

1962 CROOKE, W. M. **Effect of heavy-metal toxicity on the cation-exchange capacity of plant roots.** *Soil Sci.* 1958, **86**, No. 5, 231–40, bibl. 20. [Chem. Div., Dep. Agric., Ottawa]

Excess Ni, Co, Zn and Cu produced an increase, and Mn a reduction, in the cation-exchange capacity of roots of oats var. Victory and sunflower var. Sunrise.—E.B.O.

1963† WARREN, R. G. and JOHNSTON, A. E. **Potassium in soils. Removal of potassium by crops.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 52–4.

Yields from various crops in 2 ley/arable rotation experiments in 1954 and '55, when no K was applied, were compared with those in 1956 and '57, when supplementary K equivalent to the amount removed by the lucerne or grass ley was applied. On old grassland soil without supplementary K, the uptake of K by cut grass decreased markedly with the age of the ley. On old arable soil there was only a slight decrease. Applying extra K in 1956 and '57 prevented this fall in K uptake. A 3-yr. lucerne ley showed maximum K uptake in the 2nd year. In the presence of supplementary K, this level of uptake was maintained in

the 3rd yr. on the old arable soil but not on the old grassland soil. Where the ley was grazed, K uptake was similar at all stages of the ley and on both soils. In 1955–7, test crops of potatoes following the leys, which had received no K, showed the following responses to K : 1·3 tons/ac. after lucerne ; 1·9 tons/ac. after cut grass ; 0·8 tons/ac. after grazed ley. In 1958, when the potatoes followed leys which had received K, the test dressings had no effect on yield.—A.M.H.

1964† Sutcliffe, J. F. **Salt uptake in plants.** *Biol. Rev.* 1959, **34**, No. 2, 159–220, bibl. 219. [Bot. Dep., King's Coll., Univ. London]

1965 Alphen, T. G. van. Bespuiting met koper op verschillende gewassen. [**Spraying crops with copper.**] *Cent. Landbouwdoc. Literatuuroverzicht* 1957, **20**, pp. 65, bibl. 368, English summary. [Inst. Soil Fert., Groningen]

The literature is reviewed and the role of Cu in plant metabolism is stressed. Foliar spraying with Cu results in rapid absorption of the element and may be decisive in saving crops from deterioration. There is little conclusive evidence on the value of top-dressing the soil with Cu compounds, which is a common method used in attempting to control Cu-deficiency. F. Eng. s.—G.M.R.

1966† Antoniani, C. L'azione fisiologica degli elementi minerali principali sulle piante secondo le nuove conoscenze scientifiche. [**The physiological effect of the principal mineral elements on plants according to recent scientific knowledge.**] *Ann. Fac. Agr., Milano* 1957 (1958), **6**, 7–19, bibl. 37, English summary. [Ist. Industr. Agr., Univ. Milano]

1967† Baranger, M. Les plantes opérent-elles la transmutation des elements ? [**Do plants effect the transmutation of elements**?] 1958, pp. 6, École Polytech., 25th Ser. [Bureau translation available]

This is a summary of a lecture, given at the École Polytechnique on 2 Dec., 1958, which was concerned with the question : do plants obtain all their constituent elements from the environment, or are they capable of synthesizing elements not present in that environment ? Certain investigations in previous centuries on the subject are reviewed. An account is then given of the author's investigations with Cerdagne vetch during 4 years. In one experiment, determinations were made of the P and K content of the following : (a) 100 lots of seed ; (b) plants grown from 100 lots of similar seed germinated in distilled water during 30 days ; (c) as (b), but germinated for 45 days ; (d) as (b) but $CaCl_2$ added to the distilled water. From the results, the general conclusions were : (a) there was a significant decrease in P content in plants grown in the presence of Ca ; (b) although non-germinated seeds and plants from seed germinated in distilled water during 30 or 45 days showed no significant changes in K content, those which germinated in a Ca environment showed a significant increase in K content of about 10% ; (c) there was a significant increase, of about 1·5–2·5%, in Ca content during growth in pure water or in water containing Ca. It is, therefore, thought possible that, under certain conditions, plants are capable of forming elements which did not exist in their environment. The practical consequences of this fact are briefly discussed.—E.B.O.

CHEMICAL ANALYSES AND COMPOSITION

1968 Vlasjuk, P. A. and others. [**The localization of manganese in certain cellular structures of plants.**] [Russian] *Izv. Akad. Nauk, SSSR (Bull. Acad. Sci., USSR, Biol. Ser.)* 1959, No. 3, 368–78, bibl. 12, English summary. [Ukrainian Inst. Pl. Physiol., Kiev]

The plants studied included winter wheat, barley, lupin, beans, flax, sugar-beet, maize and buckwheat. There is evidence that in the seeds the greatest amount of Mn is localized in the non-green cytoplasmatic structures and less is found in the chloroplasts ; the Mn compounds are more stable in the reproductive organs than in the vegetative organs. Water-soluble Mn predominates in the vegetative organs. F. s.—M.H.

1969† Bertrand, G. and Silberstein, L. Relation entre les espèces végétales et leur teneur en manganese. [**Relationship between plant species and their manganese content.**] *C.R. Acad. Agric. Fr.* 1958, **44**, No. 4, 184–7, bibl. 5.

A previous paper gave an account of investigations into the Mn content of 501 samples of plants, including 462 species [see *Fld Crop Abstr.* 9 : 985]. In further investigations mainly in Finistère, Limousin, S.W. France and Switzerland, 150 specimens were studied, which included 137 species not previously analysed, bringing the total of species studied to 599. A table shows the average Mn content (mg./kg. dry matter) for species in each of the families studied. This value is 82·5 for the Gramineae and 65 for the Leguminosae.—E.B.O.

1970 Nair, G. G. K. and Mehta, B. V. **A note on zinc contents of plants grown in goradu soil.** *Indian J. Agron.* 1958, **3**, No. 2, 116–17, bibl. 2. [Inst. Agric., Anand]

Mature leaves of 84 species of crop plants growing in the Kaira District of Bombay State were analysed for Zn content. The Zn content ranged in legumes from 30·5 to 43·0 ppm. (*Cajanus cajan*) ; in cereals from 20·0 to 42·5 ppm. (*Oryza sativa*) ; in cotton it was 46·0 ppm.—D.B.

1971† Strebeyko, P. and Karwowska, Z. Zawartość wody w liściach roślin uprawnych. (Badania metodyczne). **Water content in leaves of cultivated plants. (Studies on methodics).** *Roczn. Nauk rol.* 1958, **78**, Ser. A, No. 4, 565–78, bibl. 12, Russian and English summaries.

TECHNIQUES AND APPARATUS

1972† Haber, W. Ökologische Untersuchungen der Bodenatmung. [**Ecological studies of soil respiration.**] *Flora, Jena* 1958, **146**, No. 1/2, 109–57, bibl. 100 (approx.), illus. [Bot. Inst., Landw. Hochsch. Hohenheim, Stuttgart-Hohenheim. W. Germany]

This paper deals especially with methods, both past and present. Some results are given of measurements of soil respiration during day and night in various habitats.—D.B.

1973† Jurcev, V. N. [**The use of vital stains for determining the vitality of pollen from grasses and other plants.**] [Russian] *Izv. Timirjazevsk. S.-H. Akad.* (*Bull. Timirjazev agric. Acad.*) 1959, No. 2 (27), 75–86, bibl. 39.

1974 Wiersum, L. K. **Density of root branching as affected by substrate and separate ions.** *Acta bot. néerl.* 1958, **7**, 174–90, bibl. 58, illus. [Inst. Soil Fertility, Groningen]

An experimental technique has been devised to investigate the possibility that the colloidal substances in the soil, such as humus and clay, may have some specific influence on density of branching in roots. Results were obtained which demonstrate that, in model experiments with peas, peat and clay stimulate the outgrowth of many laterals. F. s.—G.M.R.

1975† Eger, G. Untersuchungen zur Methode der Transpirationsbestimmung durch kurzfristige Wagung abgeschnittener Pflanzenteile, besonders an Wiesenpflanzen. [**An examination of the rapid-weighing method for determining transpiration, especially in meadow plants.**] *Flora, Jena* 1958, **145**, No. 3/4, 374–420, bibl. 26. [Univ. Göttingen, W. Germany]

Using the rapid-weighing method, the transpiration of *Holcus lanatus*, *Arrhenatherum elatius*, *Poa pratensis*, and *Zea mays* (among other plants) was studied. Records are given of transpiration intensity of the above plants when grown in water- and pumice-culture in glasshouses, under artificial light and in moist air under sunlight. The measurement of transpiration in the field by this method is discussed.—D.B.

1976† Garin, A. and Thellier, M. Sur une méthode de microdétermination et de microdosage du bore dans une solution ou un tissu végétal par bombardement aux neutrons lents. [**A method for the microdetermination and microdosage of boron in a solution or a plant tissue by bombardment with slow neutrons.**] *Bull. Soc. franç. Physiol. vég.* 1958, **4**, No. 2, 63–6. [C.E.A., Saclay et Physiol. Vég., Sorbonne, Paris]

1977† Munk, H. von. Die Bestimmung geringer Mengen Magnesium in pflanzlichen Substanzen mit Titangelb. [**Determination of small quantities of magnesium in plant material with titanium yellow.**] *Landw. Forsch.* 1958, **11**, No. 4, 249–56, bibl. 12, English and French summaries. [Landw. Versstat. Bladenhorst]

In strongly alkaline solutions (pH > 12) colloidal solutions of magnesium hydroxide react with titanium yellow to form a red absorption compound which can be utilized colorimetrically, provided no precipitation occurs. Numerous estimation techniques based on this principle were critically examined. The author presents an analytical technique where (a) polyvinyl alcohol delays the precipitation of $Mg(OH)_2$, (b) interfering ions (Mn, Fe, Al, CaO, P_2O_5) are either eliminated or masked, (c) interference by SiO_2 is conveniently eliminated by wet, instead of dry, ashing. Good agreement was obtained with the gravimetric ($Mg_2P_2O_7$) and flame-spectrometric techniques. F. Eng. s.—D.B.

1978† Lisanti, L. E. Applicazione della fluorescenza da raggi X per la determinazione di alcuni costituenti minori nelle piante. [**Application of X-ray fluorescence for determining some minor constituents in plants.**] *Ric. sci.* 1958, **28**, No. 12, 2540–4, bibl. 4, English, French and German summaries. [Cornell Univ.]

Determinations were made of the Zn, Mn, Se and Mo content of plants by means of X-ray fluorescence. The data obtained by this method agreed satisfactorily with those obtained by the chemical method. F. s.—E.B.O.

1979† Ludwieg, F. von. Die quantitative Bestimmung von Strontium-89, Strontium-90, Barium-140 und Cäsium-137 in Pflanzen und Milch. [**Quantitative determination of ^{89}Sr, ^{90}Sr, ^{140}Ba, and ^{137}Cs in plants and milk.**] *Landw. Forsch.* 1958, **11**, No. 4, 257–65, bibl. 13, English and French summaries. [Univ. Göttingen, W. Germany]

A radiochemical technique used for the quantitative estimation of the above isotopes in rain, grass and milk is described.—D.B.

1980† Booth, A. and others. **Use of radioactive tracers in studies of the shoot apex.** *Nature, Lond.* 1959, **183**, No. 4675, 1580–2, bibl. 2, illus. [Bot. Dep., Univ. Manchester]

1981† Orchard, B. **Measurement of leaf area.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 81.

An instrument is described which uses a scanning method for measuring the areas of sugar-beet leaves, in the range 10–1000 sq. cm. The leaf is placed against a white background and a light beam, interrupted by a shutter, is made to traverse the background and the leaf by means of a rocking mirror. Pulses of light are reflected from the background but not from the leaf and the total number not reflected is recorded. A single pulse corresponds to 0·5 sq. cm. of scan. Leaves that will lie within a rectangle of 50 × 30 cm. can be measured in 10 sec.—A.M.H.

1982† Donovan, L. S. and others. **A photo-electric device for measurement of leaf areas.** *Canad. J. Pl. Sci.* 1958, **38**, No. 4, 490–4, bibl. 6, illus. [Can. Dep. Agric., Ottawa, Ontario]

Leaves for measuring are placed between a light source and a photo-electric cell. Novel features are (a) uniform irradiation of the specimen stage by the use of fluorescent light in a specially designed light box, and (b) elimination of the transmission of yellow-green light through the specimen leaf by using lamps emitting much red light and by covering the photocell with a filter transparent to light of wavelength >610mμ.—J.D.J.

1983† Šul'gin, I. A. and others. [**A photoelectric method for determining the optical properties of plant leaves.**] [Russian] *Fiziol. Rast.* (*Pl. Physiol., USSR*) 1958, **5**, No. 5, 473–6, bibl. 14, illus. [Timirjazev Inst. Pl. Physiol., Moscow]

The method is based on the use of an integrating sphere which permits study of undamaged whole leaves on the plant and measurement of extremely weak intensities of light.—M.H.

1984 Alberda, T. **The phytotron of the Institute for Biological and Chemical Research on Field Crops and Herbage at Wageningen.** *Acta bot. néerl.* 1958, **7**, 265–77, bibl. 6, illus.

1985† Bjorkman, O. and others. **The phytotron at the Institute of Genetics, Uppsala, Sweden.** *Ann. Acad. Reg. Scient. Upsal.* 1959, **3**, 5–20, bibl. 2, illus.

The phytotron at the Institute of Genetics, Uppsala, was completed in 1957 and provides facilities for continuously varying the temperature and humidity of the environment of plants within wide ranges and reproduces any given environmental condition as often as required. The phytotron is described, with particular reference to the arrangements for controlling temperatures and humidity. A brief report is given of biological tests during 1958, using *Solidago virgaurea*. The main problems it is intended to investigate concern the physiological and biochemical causes of ecotype differentation in higher plants.—P.J.B.

1986 Chopin, M. and Chopin, G. Sur la normalisation du dosage de l'eau dans les céréales. [**On standardization in the determination of moisture content in cereals.**] *C.R. Acad. Agric. Fr.* 1958, **44**, No. 3, 154–6, bibl. 1.

A method for the determination of moisture content in cereal grains is described.—E.B.O.

1987† Wells, D. G. **A useful plant marking tag.** *Agron. J.* 1959, **51**, No. 2, 119–20. [Mississippi Agric. Exp. Sta.]

The use of laundry "daily delivery" tags made of stiff white or red cloth for labelling cereal plants is described. The tags are attached by wire spring clips which also secure the glassine or waxed paper bags used for covering emasculated heads.—A.M.H.

RADIOBIOLOGY

1988† Romney, E. M. and others. **Influence of calcium on plant uptake of ^{90}Sr and stable strontium.** *Soil Sci.* 1959, **87**, No. 3, 160–5, bibl. 14. [Univ. California, Los Angeles]

In the experiments described, beans (*Phaseolus vulgaris*) were grown in either nutrient solutions or pots containing : (a) Sassafras sandy loam, acid and Ca-deficient ; (b) Hanford sandy loam, neutral and fertile ; or (c) an alkaline-calcareous sandy loam from Yucca Flat, Nevada Test site. Ladino clover (*Trifolium repens*) was grown in Sassafras soil only. With beans, the uptake of ^{90}Sr and Sr from nutrient solutions was reduced by the addition of $CaSO_4$, and from the Sassafras sandy loam by the addition of $CaCO_3$ and $CaSO_4$. With Ladino clover the inhibiting influence of Ca on the uptake of ^{90}Sr persisted over prolonged cropping periods. Neither form of applied Ca reduced the uptake of ^{90}Sr or Sr by beans grown in soils (b) and (c). The addition of Ca, therefore, appeared to provide little protection against crop uptake of the radio-strontium fission products from soils high in Ca. The Sr/Ca atom ratios and distribution factors for beans were dependent upon the concentration of these cations in the nutrient substrate and the method for assessing Sr and Ca available to the plant. In the presence of Ca levels adequate for plant needs, the Ca content in the plant reached a maximum concentration. In the presence of excess amounts of Ca, the absorption of Ca proceeded at a reduced rate relative to the rate of Sr absorption, and a discrimination occurred in favour of Sr.—E.B.O.

1989† Menzel, R. G. and Heald, W. R. **Strontium and calcium contents of crop plants in relation to exchangeable strontium and calcium in the soil.** *Proc. Soil Sci. Soc. Amer.* 1959, **23**, No. 2, 110–2, bibl. 8. [Eastern Soil and Water Mgmt Res. Br., Agric. Res. Serv., USDA, Beltsville, Maryland]

1990 Guljakin, I. V. and Judingeva, E. V. **[Accumulation and distribution of radioactive fission products in organs of plants grown in sand cultures.]** [Russian] *Izv. Timirjazevsk. S.-H. Akad.* (*Bull. Timirjazev agric. Acad.*) 1959, No. 1 (26), 35–48, bibl. 4, illus., English summary.

The study was made with wheat and peas. The radioactive isotopes of Sr and Ce are taken up actively by the plants, being accumulated mostly in the above-ground parts. The fission products contaminate sand and sandy soils particularly.—M.H.

1991 Goss, J. A. and Romney, E. M. **Effects of bicarbonate and some other anions on the shoot content of P^{32}, Ca^{45}, Fe^{59}, Rb^{86}, Sr^{90}, Ru^{106}, Cs^{137}, and Ce^{144} in bean and barley plants.** *Plant and Soil* 1959, **10**, No. 3, 233–41, bibl. 28. [Bot. Dep., Univ. Calif., Los Angeles]

Atlas barley was grown in aerated culture solutions containing 10 milliequivalents of NaCl, $NaNO_3$, Na_2SO_4 or $NaHCO_3$/l. and 5μc. of ^{32}P or ^{45}Ca, or 10μc of ^{86}Rb. The pH of the culture solutions was adjusted to 8·1 with NaOH. In the case of barley, the effect of the 4 salts on the shoot content of ^{32}P, ^{45}Ca and ^{86}Rb absorbed from the culture solutions was studied. $NaHCO_3$ significantly reduced the content of all tracer elements in the shoots. The content of ^{45}Ca in the shoots was significantly reduced by NaCl, $NaNO_3$ and Na_2SO_4, and that of ^{86}Rb by Na_2SO_4.—R.B.

1992 Sisakian, N. M. and Kalacheva, V. Y. **The effect of X-irradiation on the synthesis of protein in the shoots of rye.** *Biophysics* (USSR), 1958, **4**, 471–4. (English translation.) [From *Nuclear Sci. Abstr.* 1958, **12**, No. 22, 2003]

During the first 4 hr. after the exposure of 10-day-old rye seedlings to 5000r of X radiation, an activation of protein synthesis was noted. During the next 24 hr. the rate of protein synthesis decreased to the level of the control. A dose of 10,000r resulted in an immediate 15–25% decrease in protein synthesis. This inhibition increased with time and in 24 hours reached 75%. Glycine labelled with ^{14}C was employed in the studies.—J.D.J.

1993 Korohoda, J. and others. Rozpoznawanie niektórych gatunków roślin krzyżowych przy pomocy chromatografii bibułowej. **Identifying certain species of cruciferous plants by means of paper chromatography.** *Roczn. Nauk rol.* 1958, **78**, Ser. A, No. 4, 667–81, bibl. 14, Russian and English summaries.

The study is concerned with varieties and/or forms of *Brassica napus*, *B. rapa*, and *B. oleracea*, in addition to *B. nigra*.—M.H.

MISCELLANEOUS

1994 Monteith, J. L. and Szeicz, G. **Measurement of carbon dioxide flux [over a sugar-beet crop.]** *Rep. Rothamsted Exp. Sta., 1958*, Harpenden, 1959, 38–9.

From Aug. to Oct. the diurnal changes in CO_2 concentration 10 and 35 cm. above a sugar-beet crop were measured, using an infra-red gas analyser. During daytime in Aug. and Sept., CO_2 moved from air to crop, as the crop assimilated, and in the reverse direction at night. In Oct., the flux of CO_2 from air to crop was detectable only in bright sunshine and there was evidence that in other daytime periods the CO_2 requirements of the crop were obtained from the soil.—A.M.H.

1995† Tamm, E. and Krzysch, G. Beobachtungen des Wachstumsfaktors CO_2 in der Vegetationszone. **[Observations on the growth factor CO_2 in the phytosphere.]** *Z. Acker- u. PflBau* 1959, **107**, No. 3, 275–300, bibl. 8, English summary. [Techn. Univ. Berlin, Germany]

The infra-red absorption recorder was used for the continuous analysis and automatic recording of the CO_2 content of the air within a well established crop stand and above it to a height of 15m. A graph shows the cycle of changes in the CO_2 content of air at various levels within a sugar-beet stand and in the freely moving air above it. During the day, when the effect of plant assimilation is dominant, the CO_2 content of air is higher above than within the plant stand. Between sunset and dawn the effect of respiration by plant and soil becomes the dominant influence; CO_2 accumulates, and the percentage is higher within than above the stand, though the content above the stand also rises. The effect of wind on the CO_2 content of the air was studied within a catch-crop mixture. Slight movements of air, even within a dense stand, prevented the nightly accumulation of CO_2 within the phytosphere. Strong wind nullified any difference in the CO_2 content of different layers of the air. On the other hand, movements of the air by day ensured supplies of CO_2 for assimilation. Secondary peaks of CO_2 content at intervals during the day were attributed to global radiation.—D.B.

1996† Šul'gin, I. A. and Klešnin, A. F. **[The correlation between the optical properties and chlorophyll content of plant leaves.]** [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1959, **125**, No. 6, 1371–3, bibl. 2. [Timirjazev Inst. Pl. Physiol., Moscow]

The plants (chiefly mesophytes) were collected from the European part of the USSR and included wild herbage and cultivated species, among others. The optical properties of the leaves were determined by the method recorded in Abs. 1983 and the chlorophyll content was determined spectro-

photometrically. It is concluded that in the majority of the species the light which is transmitted, reflected or absorbed by leaves is not dependent on their chlorophyll content (usually present in abundance).—M.H.

1997† Németh, G. **A new nitrogen-fixing micro-organism producing a red pigment.** *Nature, Lond.* 1959, **183,** No. 4673, 1460–1, bibl. 1. [Agric. Exp. Sta., Nyirtelek, Hungary]

While isolating strains of *Rhizobium lupini* from the nodules of *Lupinus luteus* grown on an acid sandy soil in north-eastern Hungary, the author isolated, on a *Rhizobium* medium, two red micro-organisms which have been labelled *Pr* and *E.3.* Their properties indicate that the organisms are varieties of a new kind of *Saccharomyces.* A correlation between the degree of N-fixation and the red colour suggests that the red pigment may have a role in fixing atmospheric N similar to that of leghaemoglobin.—M.H.

1998† Sandison, A. **Some problems in naming varieties.** *J. nat. Inst. agric. Bot.* 1958, **8,** No. 2, 253–6, bibl. 7.

The definitions of the term "variety" ("cultivar") in the International Code of Nomenclature for Cultivated Plants and in the Report of the Committee on Transactions in Seeds are reviewed. The practical application of these definitions is discussed.—A.M.H.

WEEDS AND WEED CONTROL

Where weeds are specific to a crop see under the crop concerned. See also Abs. 2081, 2083, 2090.

1999 Thurston, Joan M. **Weed studies. Wild oats.** *Rep. Rothamsted Exp. Sta. 1958,* Harpenden, 1959, 83–4.

In a field at Bishop's Stortford where stubble-burning stimulated germination of *Avena fatua* seeds [see *Fld Crop Abstr.* 11 : 1756] peas were sown after several spring cultivations, but became so badly infested that they were cut for silage before the wild oats shed seed. This treatment reduced the number of wild oat seeds in the top 6 in. of soil in Oct. 1958 to 3% of that a year earlier.—A.M.H.

2000 Zonderwijk, P. and Dord, D. C. van. De wilde haver (*Avena fatua* L.) in Nederland. **Wild oats (*A. fatua*) in the Netherlands.** *Meded. LandbHogesch. Gent* 1958, **23,** Nos. 3 and 4, 959–69, English and German summaries. [PlZiektenk. Dienst, Wageningen, Netherlands]

Four sspp. of wild oats, whose distinguishing seed characteristics are given, were found to occur in the Netherlands in the following proportions : ssp. *hybrida,* 42% ; ssp. *pilosissima,* 25% ; ssp. *intermedia,* 25%, ssp. *glabrata,* 8%. Fields with wild-oat infestations of long standing frequently contained all 4 sspp. The relative occurrence of each ssp. depended on soil conditions and the type of crop grown. Wild-oat seeds did not germinate well in dense stands of winter cereals. Spring oats and spring barley appeared to offer a more favourable environment to this weed than did spring wheat. Wild oats seldom produced ripe seed in flax or peas, owing to early harvesting. Burning the cereal stubble caused many wild-oat seeds to germinate in autumn and therefore fail to set seed. The limitation of spring-cereal growing, and machine- or hand-weeding, are the only recommended control measures. Pre-emergence applications of herbicides have given disappointing results, since wild-oat seeds germinate over a period of 4–6 weeks.—R.B.

2001 Herbold, —. Zum Problem der modernen Queckenbekämpfung auf landwirtschaftlich genutzten Flächen. [**The problem of couch grass control in agricultural practice.**] *Meded. LandbHogesch. Gent* 1958, **23,** Nos. 3 and 4, 970–5, bibl. 23.

This is a review article.—R.B.

2002† Chimingo. La lutte contre *l'Imperata.* [**Control of *I. cylindrica.***] *Chiminco* 1958, No. 17. [Reviewed in *Bull. agric. Congo belge* 1959, **50,** No. 1, 208–9.]

Different methods for controlling *Imperata cylindrica,* mainly by chemical treatment, are outlined.—E.B.O.

2003† Photiades, T. **Palloura and its control.** *Countryman, Nicosia* 1959, Apr., 26–7.

A description is given of palloura (*Zizyphus lotus*). This perennial weed was controlled by spraying it freely in June-July with 2,4,5-T at 39 ml. per gal. diesel oil. Bushes with foliage not reduced by cutting in the previous 3–4 years are more susceptible and a complete kill may result from one application, only. [See also *Fld Crop Abstr.* 12 : 407.]—E.B.O.

2004† Levi, E. **The control of water couch, *Paspalum distichum* L. in irrigation channels by 3-amino, 1, 2,4-triazole (amizole).** *J. Aust. Inst. agric. Sci.* 1959, **25,** No. 1, 62. [CSIRO Irrig. Res. Sta., Griffith, N.S.W.]

Amizole [amitrol] at 50 lb. in 100 gal. water/ac. effectively controlled *P. distichum* in drainage channels in the Murrumbidgee Irrigation Area, N.S.W.—A.M.H.

2005 Thornton, B. J. **Colorado reports on control of perennial weeds.** *Du Pont agric. News-Lett.* 1959, **27**, No. 2, 4–5.

Stands of *Convolvulus arvensis* were eradicated within 1 yr. of spraying the foliage in Aug. with 2,3,6-TBA at 15 or 20 lb. a.e./ac. Where TBA was applied to the soil in Nov., 90% control of *C. arvensis* and *Centaurea repens* was achieved with 20 lb. a.e./ac. and almost complete control with 40 lb. a.e./ac. *C. repens* was effectively controlled by 10 lb. TBA/ac. applied in July. TBA at 10 and 20 lb./ac. applied in Aug. reduced stands of *Cirsium arvense* by 90 and 95% respectively within 1 yr. of spraying. Stands of *Euphorbia esula* were reduced by 95% within 1 yr. of applying 20 lb. TBA/ac. in May. Limited trials indicated that yields of sugar-beet and barley would suffer where these were grown on areas treated with TBA during the previous year.—R.B.

2006† Slaats, M. and Stryckers, J. Les plantes adventices des champs et leur destruction. [**Field weeds and their control.**] 1958, pp. 88, illus., Brussels : Minist. Agric.

In this pamphlet the weeds of Belgium are illustrated (some in colour) and briefly described. The notes given on each weed include : popular names, distinctive characters for identification, control measures. [See also *Fld Crop Abstr.* 1551.]—E.B.O.

2007† Healy, A. J. **Unintentional introduction of plants into New Zealand.** *N.Z.J. agric. Res.* 1959, **2**, No. 2, 312–3, illus. [Bot. Div., DSIR, Christchurch, N.Z.]

The significance is discussed of the introduction of weeds into New Zealand by means of (1) straw sheaths of bottles, (2) wheat straw wrappings around plate glass, and (3) fruits and seeds lodged in folds of tourists' clothing.—M.H.

2008† Krach, K. E. Untersuchungen über die Ausscheidung unverdauter Klee-, Gras- und Unkrautsamen durch Vögel und die Beeinflussung ihrer Keimwerte durch die Magen- und Darmpassage. [**The excretion of undigested seeds of clover, grasses and weeds by birds and the effects of passage through the stomach and intestines on their viability.**] *Z. Acker- u. PflBau* 1959, **107**, No. 4, 405–34, bibl. 32, English summary. [Inst. PflBau u. PflZücht., Univ. Göttingen, W. Germany]

Caged sparrows, pigeons, pheasants and rooks were fed with the seed of certain grasses, clovers and weeds of agricultural land, viz. *Chenopodium album, Rumex acetosa, Polygonum convolvulus, Daucus carota, Centaurea jacea, Holcus lanatus, Bromus mollis, Trifolium pratense, T. repens* and *Medicago lupulina.* A study was made of the elimination and viability of these seeds after passing through the digestive tract of each of the above bird species. Seed of *B. mollis* was destroyed during its passage through all the birds tested ; seed of most other species was destroyed by some but not by all birds. Rooks appear to allow most seeds to pass through in a viable condition. For example, seeds of *D. carota, C. jacea, T. pratense* and *M. lupulina* were almost completely destroyed by all birds except rooks. 'Hard' seed may be excreted in a more viable condition.—D.B.

2009 Roberts, H. A. **Weed investigations.** *Rep. nat. veg. Res. Sta., Warwick 1958*, 1959, **9**, 40–2, bibl. 3.

In an experiment on the effect of cultivations on the survival of weed seeds in soil, more seeds of *Poa annua, Senecio vulgaris, Stellaria media, Capsella bursa-pastoris* and *Veronica persica* remained after rotary tillage than after ploughing. Simazine used as a residual pre-emergence treatment for spring-sown field beans gave significant reductions in crop growth when used at 1 lb./ac. or above, but gave good weed control without crop damage when used at 0·5–0·75 lb./ac.—A.M.H.

2010† Welbank, P. J. **Competition between crop and weeds.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 86–8.

Kale and sugar-beet plants were grown in pots alone or with *Chenopodium album, Stellaria media* or *Capsella bursa-pastoris. C. album* decreased crop growth most ; its effect on the relative growth rate of sugar-beet was 3–4 times that of the other weeds. Kale was much less susceptible than sugar-beet to competition from *C. album* or *S. media*, but there was little difference between crops in the effect of *C. bursa-pastoris.* Leaf growth of sugar-beet was depressed by *C. album* and *S. media* more at a high than at a low rate of N supply, suggesting that competition depended on factors other than N. Attempts were made to show production of toxic substances by *Agropyron repens.* In nutrient solutions, leachate from *A. repens* roots and rhizomes had no effect on wheat and barley after 3 weeks and increased the dry weight and leaf area of kale plants after 4 weeks. The leachate also had no inhibitory effect on kale plants in soil.—A.M.H.

2011† Woodford, E. K. **Chemical weedkillers —their possibilities and some problems.** *J. Fmrs' Club* 1959, Pt 1, 1–8, bibl. in text, illus. [A.R.C. Unit of Exp. Agron., Dep. Agric., Univ. Oxford]

The possible effects of herbicides on the need for crop rotation and cultivation are discussed.

The range of herbicides commercially available in Britain is described, with special reference to those for use on cereals. The problems of nomenclature of herbicides and the risks involved in their application are discussed.—A.M.H.

2012 Lillie, D. T. **Effects of carriers and soil incorporation on the efficiency of pre-emergence herbicidal applications.** *Diss. Abstr.* 1959, **19**, No. 6, 1153–4. [Rutgers Univ., New Jersey]

In glasshouse trials, the effectiveness of pre-emergence herbicidal applications [herbicides not specified] applied to, or incorporated into, the soil surface, was compared. Where no water was applied after herbicidal treatment, incorporation was more effective than surface applications against test plants [not specified]. Where water [amount not stated] was applied after herbicidal treatment, both methods were equally effective and the effectiveness of both was increased. There was evidence that herbicides incorporated into the soil could be leached by heavy rain to a depth sufficient to injure crop seed. Impregnating dry carriers with herbicides, reduced their liability to leaching. In field trials with maize, incorporating herbicides into the soil adversely affected maize stands as a result of mechanical injury and weed control was less effective than with surface applications. Applying the herbicides as aqueous sprays gave better weed control than applying them on dry carriers where rainfall was limited ; with adequate moisture, both methods of application were equally effective.—P.J.B.

2013 Mukula, J. and Pirttilä, H. Monokloretikkahapon (MCA) käyttömahdollisuuksista kasvinviljelyssä. **Sodium monochloroacetate as a selective weed killer and plant defoliant.** *Maatal. ja Koetoim.* **13**, 47–53, English summary. [Agric. Res. Centre, Tikkurila, Finland]

In field trials, MCA was almost as effective a contact weedkiller as DNOC for controlling weeds resistant to MCPA, e.g. *Spergula arvensis*, *Polygonum lapathifolium* and *Stellaria media*. Oats (Pendek) were practically undamaged by this herbicide, but spring wheat (Diamond) showed slight scorch. MCA can be applied to spring cereals at a rate of 20–25 kg./ha. By adding a wetting agent to the solution, MCA effectively defoliated clover grown for seed production, and also was effective for defoliating potato crops. F. Eng. s.—M.H.

2014 Stryckers, J. Ervaringen met 4-(MCPB), 2-(MCPP) en 2-(2,4,5-TP). [**Trials with 4-(MCPB), 2-(MCPP) and 2-(2,4,5,-TP).**] *Meded. LandbHogesch. Gent* 1958, **23**, Nos. 3 and 4, 926–39, bibl. 9, illus., English, French and German summaries.

The relative effects of these herbicides on peas, beans, fibre flax, potatoes and cereals and on weeds in these crops are discussed. [See Abs. 949.]—R.B.

2015 Pfeiffer, R. K. **A new advance in selective weed control in cereals.** *Meded. LandbHogesch. Gent* 1958, **23**, Nos. 3 and 4, 940–3. [Chesterford Park Res. Sta.]

CP 18-15, which is a mixture of MCPA and 2,3,6-TBA, controlled many weeds resistant to MCPA alone and 2,4-D. TBA was readily translocated and was as effective in cold weather as in normal growing conditions ; after treatment, weeds ceased to grow and no longer competed with the crop. In the absence of weeds, TBA at 0·5 lb./ac. depressed cereal yields by approximately 10%, while TBA at 0·25 lb./ac., in combination with MCPA, had no effect on yields and produced less ear deformity than recommended rates of 2,4-D. The optimum spray volume was 6–10 gal./ac. CP 18-15 applied after the jointing stage tended to cause damage to the crop, especially under dry conditions.—R.B.

2016† Karapetjan, N. [**A new herbicide—crotilin.**] [Russian] *Nauka Pered. Opyt Sel'sk. Hoz.* (*Sci. Adv. exp. Agric.*) 1959, No. 6, 45. [Armenian Agric. Inst.]

This substance (a low-volatile ester of 2,4-D) has been synthesized at the above Institute and is claimed to be superior to the butyl ester of 2,4-D in herbicidal qualities, in addition to being cheaper. A dose of 0·5 kg. active principle in 100 l. water/ha. shows effect in 6–8 hr. on most annual and perennial weeds. For tenacious weeds, e.g. *Convolvulus arvensis*, 1 kg. of the active ingredient should be applied.—M.H.

2017 Bowen, H. J. M. and Smith, S. R. **Effect of gamma-radiation on weeds.** *Nature, Lond.* 1959, **183**, No. 4665, 907, bibl. 8, illus. [Wantage Lab., Grove, Berks]

The doses of γ-radiation required to prevent weed seed growth have been studied with seeds of 24 weed species which were first stored at 32% rel. humidity and irradiated in air with doses ranging from 0–100,000 rads γ -radiation from ^{60}Co. The seeds were then grown in sterilized soil. There is evidence that at least 100,000 rads of γ radiation are required to inhibit weed growth in arable soils. —M.H.

SURVEYS AND LAND USE

SURVEYS

2018 Long, H. and others. **The small farms of industrial Yorkshire. A study of some social and economic aspects of farming in the industrial Pennines.** 1958, pp. 72, illus., Leeds : University of Leeds, Economic Section, Department of Agriculture, 3s.

2019† Cougnenc, F. Les grandes zones de colonisation en Espagne. [**The great zones of colonization in Spain.**] *Bull. tech. Inform.* 1959, No. 139, 211–19, illus.

This article is based on a visit to the principal zones of colonization in Spain, where works are being carried out to improve the land by irrigation and the introduction of intensive systems of agriculture.—E.B.O.

2020† Grellet, J. L'agriculture polonaise en 1958. [**Polish agriculture in 1958.**] *Bull. tech. Inform.* 1959, No. 139, 193–210, illus.

2021 Silva, H. L. Esboço da carta de aptidão agrícola de São Tomé e Príncipe. [**Draft map of agricultural possibilities in São Tomé and Principe Islands (Africa).**] *Garcia de Orta, Lisboa* 1958, **6**, No. 1, 61–86, bibl. 10, illus., maps, English abstract.

This map was based on information (said to be scanty) derived from maps of climate, soils and vegetation.—E.B.O.

2022 Richards, Audrey I. **A changing pattern of agriculture in East Africa : the Bemba of Northern Rhodesia.** *Geogr. J.* 1958, **124**, No. 3, 302–14, bibl. in text, illus.

2023 Mercer, J. H. and Scott, P. **Changing village agriculture in western Samoa.** *Geogr. J.* 1958, **124**, No. 3, 347–60, bibl. 11, illus.

2024 Kägi, R. C. and Benavídez, C. C. Informe agropecuario básico de la provincia de San Juan. [**Report on the agriculture and livestock of the Province of San Juan (Argentina).**] *Idia* 1958, No. 131, 1–44, illus.

Information is given on the climate, irrigation and agriculture in the province of San Juan (Andine region), an area of 96,497 sq. km., of which only 10·6% is suitable for cultivation.—E.B.O.

2025 Idia. Situación agropecuaria de Chaco y Formosa. Objetivos fundamentales de acción del Instituto Nacional de Tecnología Agropecuaria. Temas de investigación, extensión y fomento. [**Agricultural and livestock situation in Chaco and Formosa (Argentina). Fundamental objectives of the Instituto Nacional de Tecnología Agropecuaria. Subjects for investigation, extension and improvement.**] *Idia* 1958, No. 130, 1–92, illus.

Information is given on the climate, soils and crops grown in the region including the Chaco and Formosa provinces. There are 3 sub-regions : humid, semi-arid and arid. Cotton, the basis of the agricultural economy of the region, was sown, in 1957–8, on 550,000 ha., with a production of 110,800 tons of fibre, the total cotton production of Argentina being 150,000 tons. Sorghum and maize are also grown. The subjects for investigation are listed.—E.B.O.

LAND USE

2026† Gerasimov, I. P. **The geographical study of agricultural land use.** *Geogr. J.* 1958, **124**, No. 4, 452–63. [Geogr. Inst. Soviet Acad. Sci.]

Information is given on land use in the USSR. —E.B.O.

2027 Coppock, J. T. **The changing arable in England and Wales 1870-1956.** *Tijdschr. econ. soc. Geogr.* 1959, **50**, Nos. 6 and 7, 121–30, bibl. 30, maps 22.

2028† Land Development Board (Non-Scheduled Areas [Aldev]). **African land development in Kenya. Report of the Land Development Board (Non-Scheduled Areas) for the financial year 1st July, 1957 to 30th June, 1958.** [n.d.], pp. iii + 97, illus., 1 map. [Received June, 1959]

[See also *Fld Crop Abstr.* 11 : 1786.] This report follows the pattern of previous years and the location of each project is shown on a map.—C.L.S.

2029 Boerendonk, M. J. Het landgebruik op Cuba. [**Land use in Cuba.**] *Tijdschr. econ. soc. Geogr.* 1959, **50**, Nos. 6 and 7, 151–7, bibl. 8, English summary.

2030 Roche, J. L'agriculture des colons allemands dans le Rio Grande do Sul. [**Farming by German colonists in Rio Grande do Sul (Brazil).**] *Ann. Géogr.* 1959, **68**, No. 367, 224–37, illus.

FARMING SYSTEMS AND PRACTICES

2031 Kalisvaart, G. **Subirrigation in the Zuiderzee polders.** *Publ. 2 Internat. Inst. Ld Reclam. Improve.* 1958, pp. 55, illus., French, German and Spanish summaries.

2032† Montanari, V. L'irrigazione in Italia. [**Irrigation in Italy.**] *Progresso agric.* 1959, **5**, No. 4, 407–12, illus.

Data are given of the total irrigated area and the area under sprinkler irrigation in 19 regions of Italy in 1958.—E.B.O.

2033† Giorgi, E. L'irrigazione nei poderi collinari dell' Italia centrale. [**Irrigation on the farms in the hilly areas of central Italy.**] *Progresso agric.* 1959, **5**, No. 3, 289–94, illus. [Ist. Econ. e Polit. Agr., Univ. Firenze, Italy]

A large amount of irrigation water has become available in the hilly areas, mainly of central Italy, through the construction of artificial lakes, the water of which is used almost exclusively for sprinkler irrigation. Three-quarters of the irrigated land is under forage crops and the remainder under maize, sugar-beet and other crops.—E.B.O.

2034† Mohrmann, J. C. J. **Some aspects of sprinkler irrigation in tropical regions.** *Neth. J. agric. Sci.* 1959, **7**, No. 2, 118–33, illus. [Internat. Inst. Ld Reclam. Improve.]

2035 Taniguti, S. **The considerations for influence of irrigation upon the upland-field related to the natural environment and agriculture in Japan** [*sic*]. [Japanese] *Sci. Rep. Fac. Agric. Meijo* 1957, No. 2, 27–32.

2036 Vlasjuk, P. A. [**The water regime and crop productivity in the southern Ukraine.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 229–45, bibl. 10. [Inst. Pl. Physiol., Acad. Sci. Ukrainian SSR] [Received Aug., 1958]

See also *Fld Crop Abstr.* 12 : 877.

2037† Šabalin, I. N. [**The irrigation regime in Kulunda.**] [Russian] [Contained in] Biological bases of irrigation farming. Moscow, 1957, pp. 246–62. [Biol. Inst. West Siberian Filial Acad. Sci.] [Received Aug., 1958]

See also *Fld Crop Abstr.* 12 : 877.

2038 Patterson, H. D. **Three-course rotation experiment : revised scheme, summary, 1952-58.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 167–71.

The original experiment tested the effects of straw, ploughed-in in autumn or composted, on a 3-course rotation of potatoes, barley and sugar-beet. The results were reviewed in 1951 [see *Fld Crop Abstr.* 6 : 746]. A revised scheme of treatments was introduced in 1952 to test the hypothesis that the effects of straw might be due to immobilization of N and provision of K by the straw, rather than to changes in soil structure or organic-matter content. In addition to basal dressings, N was applied at 0 or 0·4 cwt./ac. and K_2O at 0 or 0·5 cwt./ac., plots receiving low and high dressings in alternate years. One-third of the plots which previously received straw or compost were now given 53 cwt. straw/ac., ploughed-in every 2nd autumn, and 0·2 cwt. N/ac. in the following spring. A further one-third of these plots received a dressing of KCl in the spring of every 2nd year, the amount calculated to be equivalent to the K supplied by the straw (average 0·45 cwt. K_2O/ac.). The remaining plots received neither straw nor its K equivalent. Neither barley nor sugar-beet responded to K. The average responses to 0·4 cwt. N/ac. were $3·3 \pm 0·27$ cwt. barley grain/ac. and $6·4 \pm 0·4$ cwt. sugar/ac. Straw + 0·2 cwt. N/ac. had little effect on yield of sugar-beet or barley, thus the effect of straw alone was concluded to be equal to the effect of the loss of about 0·2 cwt. applied N/ac. Responses of potatoes to K were irregular, but the benefit from the straw was about the same as that from an equivalent amount of applied K. The revised experiment also provided information on the residual effects of straw and compost applied in 1933–51. At the lower level of N, the old straw plots yielded $2·1 \pm 0·69$ cwt. more sugar/ac. than those which had received fertilizer only. The difference was less on the high-N plots. For potatoes the residual effects were about the same at both levels of N and averaged $0·4 \pm 0·14$ tons/ac. —A.M.H.

2039† Warren, R. G. and others. **Soil organic matter. Changes caused by leys and by arable cropping.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 42–3.

Changes in soil organic-matter content were measured under 2 ley/arable rotations, one on old grassland soil and the other on old arable soil. In the old grassland soil, about one-seventh of the organic C present when the land was ploughed from grass was lost during 6 yr. of arable cropping, or 3 yr. arable cropping + 3 yr. lucerne or grass-clover ley. On old arable land, a 3-yr. ley increased the organic C content by 10–15% and 6 yr. of reseeded grass increased it by nearly 20%.—A.M.H.

2040† Genuit, F. Über die Wirkung verschieden langer Zwischennutzungszeiten auf Boden und Neuansaat. [**The effect of varying periods of intermediate cropping on soil and on a new sward.**] *Z. Acker- u. PflBau* 1959, **107**, No. 3, 301–16, bibl. 14, English summary. [Inst. PflBau, Univ. Bonn, W. Germany]

Plots on a permanent pasture at the Research Farm, Dikopshof, Bonn, were ploughed up in one of 6 consecutive years and cropped with potatoes. The effect was studied of the varying periods (1–6 yr.) of arable cultivation on : potato yields, composition and structure of the soil, and on a resown grass sward. The highest potato yields were obtained from the most recently ploughed plot. Organic matter, porosity and water-storage capacity of the soil decreased as the period of arable cultivation increased. In the newly sown grass/clover sward, which was sown after potatoes, infestation by arable weeds was greater, the longer the plot had been under arable cropping, so that in the recently ploughed plots the new sward had a better chance to become established. Botanical analyses in the second year of establishment revealed a higher percentage of grasses in the plots which had been under arable cultivation for a short period, i.e. 90% for the short and 64% for the long. Of the newly sown pastures, the only dry-matter yields which were higher than from the original permanent pasture were those of the first cut taken from swards which had been 1 and 2 years under arable cropping. After 3 years of arable cropping the soil had deteriorated to such an extent that dry-matter yields were inferior to those of the permanent pasture.—D.B.

2041† Lüddecke, F. Versuchs- und Untersuchungsergebnisse zum Anbau der Winterzwischenfrüchte und der nachfolgenden Zweitfrüchte. [**Results of cultivation trials with winter catch-crops and the subsequent second crops.**] *Z. landw. Vers. -u. UntersuchWes.* 1958, **4**, No. 2/3, 101–250, bibl. 36, English and Russian summaries.

At the 5 Institutes (Rostock, Jena, Leipzig, Potsdam and Halle-Lauchstädt) of the Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, 243 exact experiments were conducted over a period of 3 years in 6 cultivation zones of E. Germany, on the cultivation and fodder quality of winter catch-crops and of second crops. The winter catch-crops were classified according to maturity dates, as follows : early, fodder turnip (*Brassica rapa*) and fodder rape (*B. napus*) ; medium early, 5 varieties of fodder rye ; medium late, vetch/rye, winter pea/rye, and vetch/wheat ; late, Landsberg mixture. *B. rapa*, which provided the earliest fodder (end-April), was less dependent on environment than was *B. napus*, which it should replace. Fodder rye, which provides green feed about the time cattle first go out to graze, is the most reliable winter catch-crop and can be cut for fodder up to earing stage. Double utilization, for fodder and grain, was not recommended, except in an emergency. Of the rye varieties tested, Bernburger gave the highest protein yields, and because of its nutrient requirements should be reserved for the best soils. Petkuser was less demanding than Bernburger. Petkuser Grünschnittroggen, the latest-maturing rye, was ready for cutting in the latter part of May. Vetch/rye can be relied on for cutting at the end of May. Vetch/wheat, which is somewhat later, provides a rich fodder, but its place as a winter catch-crop is limited because of its high demands on soil, climate and cultivation. Landsberg mixture is least reliable in yield, and is not ready for cutting until end-May or early June. The experiments with winter catch-crops were followed by cultivation trials with second crops (Zweitfrüchte) viz. maize for cutting green and for silage, also, potatoes and sunflower. These experiments also included investigations on the influence of the preceding winter catch-crop on the second crop. The cultivation of an early to medium-late winter catch-crop followed by early and high-yielding varieties of maize grown for green fodder or silage gave the highest total production in starch equivalent and crude protein. An advantage of this system of cultivation is that it can be completely mechanized.—D.B.

2042 Klitsch, R. Untersuchungen über Bedeutung, Anbautechnik und wertgebende Inhaltsstoffe neuartiger Zweitfrucht- und Stoppelfutterpflanzen, insbesondere der Grünsonnenblume im mitteldeutschen Trockengebiet. [**Importance of, cultivation of, and valuable nutrients in, new types of fodder plants grown as a second crop and as a stubble crop, especially green sunflower, in the dry area of Central Germany.**] *Kühn-Arch.* 1957, **71**, No. 4, 451–501, bibl. 97, illus., Russian, English and French summaries. [Inst. Acker- u. PflBau, Univ. Halle-Wittenberg, E. Germany]

The object of the experiments reported was to gain information for introducing carbohydrate-rich fodders into lucerne/sugar-beet areas of Central Germany where the fodder is too rich in protein. The fodder crops to be introduced must resist drought, be suitable for cultivation as a second crop [i.e. the second crop to be harvested in the year] or as a summer catch-crop, and produce high yields of green matter within a short growing-period. As a second crop, sown in May a few days after harvesting a winter catch-crop, green fodder-maize gave the highest yield of dry matter and of starch. Next in importance was sugar millet (*Sorghum dochna*), especially if a second cut was taken or the regrowth was grazed. This crop is suitable only for parts of Central Germany which

have dry, warm, long summers. *Helianthus annuus*, *Panicum miliaceum* and *Setaria italica* were also suitable, but not *Phalaris canariensis*, *Sorghum sudanense* and *Zea mays* conv. *microsperma*. Of the summer catch-crops (stubble crops), sown in late July, *H. annuus* produced by far the highest yield of green- and dry-matter and of starch in the short growing period. Second in importance came *Raphanus sativus oleiferus*, *Brassica juncea*, *Fagopyron sagittatum* and *F. tataricum*. Less suitable were *Zea mays* (green maize), *Setaria italica* and *Panicum miliaceum*. Because of the importance of *H. annuus*, additional cultivation experiments for improving its yield and fodder value were carried out with the following result. Instead of the present practice of sowing 20 kg. seed/ha. with a row spacing of 33 cm., a sowing rate of 40 kg./ha. with a row spacing of 25 cm. is now recommended, whether *H. annuus* is grown as a second crop or a summer catch-crop.—D.B.

2043 Panos, D. A. **The growth of legumes in conjunction with phosphate fertilizer, as a means of increasing and stabilizing soil fertility and agricultural productivity, in Greece.** *Emp. J. exp. Agric.* 1959, **27**, No. 106, 98–106, bibl. 17. [Hellenic Agric. Res. Sta., Larissa, Greece]

Experiments were carried out in 1949–57 to investigate how far the use of legumes in crop rotations can reduce the N deficit which is general in cultivated soils in Greece, and whether applying P to the legume in the rotation can replace the use of fertilizer-N. Wheat was grown in rotation with various annual legumes. Fertilizer treatments (per ha.) applied to the legume crop, only, were : (a) nil, (b), 30 kg. N, (c) 30 kg. P_2O_5, (d) 30 kg. N + 30 kg. P_2O_5, (e) 30 kg. N + 60 kg. P_2O_5, (f) 60 kg. P_2O_5. Applying 30 kg. P_2O_5/ha. significantly increased seed yields of all the legumes tested, but the 60-kg. dressing was not as effective, per kg., as the 30-kg. rate. Applying 30 kg. N/ha. did not significantly alter legume seed yields. The residual effects of the P treatments significantly increased wheat yields in most of the rotations ; the greatest yield increases were in wheat following *Pisum sativum* or *Vicia faba*. N applied to the legume had no effect on the subsequent wheat crop. The P treatments increased the content of protein and P_2O_5 in the legume seed and the protein content of the following wheat crop, but the N treatments had no such effect.—A.M.H.

2044† Baldanzi, G. Il fuoco come istrumento nell'agricoltura subtropicale. [**Fire as a tool in subtropical agriculture.**] *Rep. World Congr. agric. Res., Rome*, 7–9 May, 1959, 1189–97, bibl. 17, English, French, German and Spanish summaries. [Esta. Exp. Curitiba, Paraná, Brazil]

There is a difference of opinion in Brazil regarding the practice of burning the natural vegetation which grows during the 1–2 year fallow between 2 crops. A trial was carried out at Curitiba in 1956–7 to compare the effect of burning with that of ploughing-in such vegetation on the yield of a subsequent wheat crop. The soil of the region has a high content of organic matter ; average annual rainfall is 1266 mm., well distributed ; and there are no heavy frosts. Results showed that burning had a significant and favourable effect on wheat yield, compared with ploughing.—E.B.O.

2045 Haan, J. H. de. **A study of shifting cultivation.** *Neth. J. agric. Sci.* 1959, **7**, No. 2, 150–4. [Div. Trop. Rural Econ., Wageningen Agric. Univ., Netherlands]

A programme for a survey of shifting cultivation in tropical regions is proposed.—R.B.

SOIL AND WATER CONSERVATION

See also Abs. 2085, 2086.

2046† Kibe, M. M. **The role of vegetal cover in soil conservation.** *J. Soil Wat. Conserv. India*, 1958, **6**, No. 4, 160–6. [Agric. Res. Sta., Sholapur, Bombay State]

The findings from 20 years of erosion control experiments in areas of poor vegetation on the Bombay Deccan are summarized. Results are tabulated for run-off and soil losses under different crops and under natural vegetation. Detailed studies were made with leguminous crops. Tables give (a) soil and water losses from land under several legumes sown at different seed rates, (b) the period during which these crops provide cover, and (c) their percentage cover between August and October (incl.) when sown at different seed rates. For cultivated land it is recommended that matki [*Phaseolus aconitifolius*], or hulga or groundnut should be grown at 3 times the normal seed rate [not given] in strips < 24 ft. wide alternating with strips, < 72 ft. wide, of cereal crops. For controlling runoff and soil erosion on uncultivated land, the most effective plants are *Panicum antidotale*, *Pennisetum purpureum* and *Heteropogon contortus* with preference for the first two because of their fodder value.—D.B.

2047 Zingg, A. W. and Hauser, V. L. **Terrace benching to save potential runoff for**

semiarid land. *Agron. J.* 1959, **51**, No. 5, 289–92, bibl. 6, illus. [S.W. Great Plains Fld Sta., Bushland, Texas]

An experimental terrace system for water conservation on land of 1–1·8% slope is described. The distribution of soil moisture in the levelled portions of the terrace system was uniform where the surface did not deviate more than 0·15 ft. from the horizontal. Silage yields from Early Hegari sorghum grown on the bench terrace with 9·4 in. rainfall during the growing season averaged 11·7 tons/ac. ; grain yields were 80·3 bu./ac. Yields of silage and grain were considerably greater on the cut than on the filled side of the bench. Hybrid 610 sorghum grown on the area between the terrace yielded 40 bu. grain/ac.—R.B.

AGRICULTURAL METEOROLOGY AND CLIMATOLOGY

See also Abs. 2088.

2048 Monteith, J. L. and Szeicz, G. **Agricultural meteorology. Heat and water balance.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 37–8.

Sugar-beet was grown on the field balance used for wheat in 1957 [see *Fld Crop Abstr.* 11 : 1544]. At the seedling stage, the rate of evaporation, mainly from the soil, was about half that from an open-water surface nearby, but in July-Oct., when leaf cover was complete, crop transpiration exceeded tank evaporation by 6%. Soil moisture deficit in 1958 did not exceed 4 cm., whereas under wheat in 1957 it reached 11 cm. In a study of reflexion of short-wave radiation from leaves, seasonal variations in the short-wave reflexion coefficient of sugar-beet, wheat and potatoes were related to leaf area. When leaves completely shaded the ground the coefficient was 0·26, independent of crop type or visible colour.—A.M.H.

2049† Thornthwaite, C. W. and others. **3 water balance maps of eastern North America.** 1958, pp. 47 of explanatory text, Washington D.C. : Resources of the Future Inc., $2. [Reviewed in *Weather*, 1959, **14**, No. 6, 221.]

2050† Kinbacher, E. J. and Jensen, N. F. **Weather records and winter hardiness.** *Agron. J.* 1959, **51**, No. 3, 185–6, bibl. 1. [Cornell Univ. Agric. Exp. Sta., Ithaca, New York]

Continuous records of temperature at ground level and at a height of 5 in. were made over a 2-yr. period and compared with records made at a height of 4·5 ft. Daily minimum temperatures at 4·5 ft. frequently differed by 10–20°F. from those at ground level. When the ground was covered with snow the temperature differences were much greater. Temperature-recording at plant level is considered essential in research on the winter-hardiness of plants. [See *Herb. Abstr.* 24 : 1225.] —R.B.

2051† Wallen, C. C. Sannolikheten för långvariga torr- och ragnperioder i Sverige under vegetationssäsongen mot bakgrunden av våtperioden hösten 1957. **Probability of long-lasting drought or rain periods in Sweden during the vegetation season, in the light of the 1957 rainy period.** *K. Skogs LantbrAkad. Tidskr.* 1958, **97**, No. 3, 189–200, 3 maps, English summary.

2052† Bultot, F. Étude statistique des chutes de grêle au Congo Belge et au Ruanda-Urundi. [**A statistical study of hail storms in the Belgian Congo and Ruanda Urundi.**] *Comm. 17 Bur. climatol. INÉAC* 1959, pp. 43, bibl. 49, illus. [Bruxelles]

2053† Grigor'ev, A. A. and Budyko, M. I. **Classification of the climates of the USSR.** [Russian] *Izv. Akad. Nauk, SSSR (Bull. Acad. Sci., USSR) Geogr. Ser.*, 1959, No. 3, 3–19, bibl. 37, map. [Geogr. Inst., Acad. Sci. USSR, Principal Geophys. Observatory]

2054† Naranjo, P. Sobre microclimas del Ecuador. [**Microclimates of Ecuador.**] *Ciencia y Natur.* 1959, **2**, No. 1, 2–14, bibl. 15, map, English summary.

2055† Aslyng, H. C. **Shelter and its effect on climate and water balance.** *Oikos* 1958, **9**, No. 2, 282–310, bibl. 21, illus. [Roy. Vet. Agric. Coll., Copenhagen]

A screen 2·5 m. high and 50 m. long made of horizontal slats arranged so as to leave 45% of the total screen area open was erected in a N. to S. direction on a nearly level field exposed to the wind and used for growing white clover for seed. Wind direction, wind speed, temperature and dewpoint-temperature were continuously recorded ; records were also made of rainfall, soil moisture and soil temperature at different distances and directions from the screen during April 1955 to Sept. 1956. Potential evaporation was estimated from meteorological observations, from evapotranspirometers and, in the second summer, from evaporimeters with a small screened surface and with a large free-water surface. Shelter increased the temperature during the day more than it reduced it at night, so that the average temperature was increased. This caused a similar variation

in the saturation deficit. The higher day- and lower night-temperatures were advantageous for the net production of plant material. The increase in the risk of damage from late and early night-frost as a result of using such screens was small. Soil temperature was, on the whole, increased by shelter. As shelter reduced the wind speed it also reduced evaporation, but this was partly offset by an increase in temperature and saturation deficit during the day. The net reduction in evaporation was less in the warm summer of 1955 than in the cool one of 1956. The screens reduced potential evaporation by about one-third, but had almost no influence on rainfall. Much snow was caught by the screens, which is a drawback in Denmark where rainfall is already normally sufficient to saturate the soil at times other than during the summer season. F. S.—G.M.R.

2056† Air Ministry Meteorological Office. Great Britain. **Tables of temperature, relative humidity and precipitation for the world. Pt 2. Central and South America, the West Indies and Bermuda.** *Bull. M.O. 617b* 1958, pp. viii + 53, illus., 24 × 15 cm., 5s. 6d.

See also Abs. 476.

MISCELLANEOUS

2057 Baldacci, E. Malattie delle piante trasmesse per seme e mezzi di prevenzione. [**Seed-borne diseases of plants and preventive measures.**] *Quad. 7 Ente naz. Sementi elette* 1959, pp. 36, illus. [Milano, Italy]

The crops considered include : wheat, maize, barley, rye, oats, sorghum, rice, sugar-beet, cotton, groundnuts, flax and soyabean.—E.B.O.

2058 Way, M. J. **The use of insecticidal seed dressings.** *Rep. Rothamsted Exp. Sta. 1958*, Harpenden, 1959, 214–22, bibl. 37.

This review deals with the use of chlorinated hydrocarbon insecticides for the control of wire-worms and certain Diptera, also the use of systemic phosphorus insecticides on an experimental scale on field beans, potatoes and sugar-beet.—A.M.H.

2059 Tilemans, E. M. Zaadontsmetting met parathion. [**Seed disinfection with parathion.**] *Meded. LandbHogesch. Gent* 1958, **23**, Nos. 3 and 4, 780–7, bibl. 10, English, French and German summaries. [Rijksstation voor Phyto-pharmacie, Gembloers]

Seed disinfection with 1 kg. parathion 10% wettable powder per 100 kg. seed proved economically justifiable for a wide range of crops aud afforded protection against damage by insects, rooks and voles. The powder adhered better to smooth seeds, such as rape and linseed, when these were slightly moistened with mineral oil.—R.B.

2060 Kanervo, V. Tuloksia juurimatojen torjuntakokeista. **The control of wire-worms** [*Agriotes obscurus* **and** *A. lineatus*]. *Maatal. ja Koetoim.* 1959, **13**, 17–26, illus., English summary. [Agric. Res. Centre, Tikkurila, Finland]

This refers to the successful use of lindane and aldrin in the field.—M.H.

2061† Hagnauer, W. and Michael-Lusti, J. Versuche zur Maikäferbekämpfung mit einem systemischen Insektizid. [**Experiments in the control of cockchafers with a systemic insecticide.**] *Schweiz. landw. Mh.* 1959, **37**, No. 2, 65–73, bibl. 8.

Phosphamidon was more effective than lindane as a knock-down killer of *Melolontha melolontha*; 200–250 g. active substance per hectare were sufficient. The experiments were conducted in wooded areas, but phosphamidon is suitable for spraying where there are also ground crops, because it decomposes in the plant within 10–14 days to form two non-poisonous compounds. The usual precautions must be taken with bees.—D.B.

2062† Palmer-Jones, T. **Effect on honey bees of thiodan applied to broad beans in a cage.** *N.Z. J. agric. Res.* 1959, **2**, No. 2, 229–33, bibl. 5. [Anim. Res. Sta., Dep. Agric., Wallaceville, N.Z.]

In a cage test, thiodan was sprayed on *Vicia faba* at the rate of 56 gal. of a 1% solution per ac. The experiment shows that thiodan can be applied to broad beans in flower without causing bee mortality, provided that it is used when bees are not flying. It cannot be recommended for application to brassicas in flower. F. S.—M.H.

2063 Nagarajan, K. R. **Progress of plant protection in Madras State.** *Madras agric. J.* 1959, **46**, No. 1, 3–7.

2064 Hutchinson, Sir J. and others. **The planning of a large farm for the Namulonge Cotton Research Station in Uganda. The conditioning and storage of grains and pulses.** *Emp. Cott. Gr. Rev.* 1959, **36**, No. 2, 103–12, bibl. 20.

The use of an in-sack grain dryer for drying

cotton seed, maize, beans, groundnuts and sunflower seed is described. The cost of grain drying is discussed.—A.M.H.

2065† Laforest, G. Le complexe climat-sol. Principal facteur de la rentabilité des exploitations agricoles. [**The climate-soil complex. Principal factor determining the profitability of farming.**] *Bull. tech. Inform.* 1959, No. 139, 231–41.

This study of the climate-soil factor is concerned with conditions in various regions of France.—E.B.O.

2066† Barley, K. P. **The influence of earthworms on soil fertility. 1. Earthworm populations found in agricultural land near Adelaide. 2. Consumption of soil and organic matter by the earthworm *Allolobophora caliginosa* (*Savigny.*)** *Aust. J. agric. Res.* 1959, **10**, No. 2, 171–8, bibl. 14, 179–85, bibl. 12. [Waite Agric. Res. Inst., Univ. Adelaide]

Populations of *Eisenia rosea*, *Allolobophora caliginosa* and *Microscolex* sp. were determined under a fallow/wheat rotation begun in 1926, a rotation of fallow/wheat/2 yr. sown pasture begun in 1950, and a permanent pasture of *Phalaris tuberosa*, *Lolium rigidum*, *Trifolium subterraneum* sown in 1951. Pasture established for 6 or more years carried an average of 80 g. worms per 1000 g. annual production of dry herbage. Very few worms were found in soil which had been under the 2-course rotation for 30 yr. Under the 4-course rotation, the weight of worms fluctuated during the rotation. At the end of the ley, the weight almost equalled that under permanent pasture, but it fell by 75% after the fallow and crop years. Earthworms were active for about 24 weeks each year. The relative amounts of herbage litter, dung and mineral soil consumed by *A. caliginosa* were determined and used to estimate the magnitude of the changes brought about by the worms in soil.—A.M.H.

2067† OEEC. **Agricultural and food statistics.** *Statis. Bull. OEEC* 1959, pp. 130, map, text in English and French.

This volume assembles the principal statistical data on agriculture and food with regard to areas, means of production, employment, production, farm prices, foreign trade, availability, consumption and home food supplies both collectively and individually for the countries of western Europe, and separately for the USA and Canada. The data cover the period 1934–8 and the crop years 1947–8 to 1957–8. Special tables for Spain and Yugoslavia, countries in limited association with OEEC activities, are also included. F. introduction.—E.B.O.

2068 Australian and New Zealand Association for the Advancement of Science. **Section K : Agriculture and Forestry. Section M : Botany.** *Rep. Aust. Ass. Adv. Sci.* 1958 [contained in *Aust. J. Sci.* 1959, **21**, No. 6a, 168–9, 180–93]

The titles of papers read to Section K are listed under the main headings : assessment of post-war land development ; control of water in agriculture ; plant introduction. Papers read to Section M included : The plant factor in soil formation, by R. L. Crocker ; and others on carbohydrate metabolism, and growth regulators.—A.M.H.

2069† Agricultural Research Council. **Report for the year 1957-8.** 1959, pp. vii + 173, London : H.M.S.O.

This report contains anonymous review articles with bibliographies, entitled : Research on potatoes ; Fertilizer placement investigations ; Future developments in chemical weed control ; Trace-element deficiencies in crops.—A.M.H.

REPORTS

2070 **Great Britain.** Report of the Rothamsted Experimental Station for 1958. Harpenden, 1959, pp. 283, illus., 1 map.

See Abstracts 1660, 1661, 1791, 1816, 1830, 1832, 1836, 1857, 1877, 1954, 1959, 1963, 1981, 1994, 1999, 2010, 2038, 2039, 2048, 2058.

2071 **Great Britain.** Agricultural Research Council. Report for the year 1957–8. 1959, pp. vii + 173, London : H.M.S.O.

2072 **Great Britain.** Ninth Annual Report 1958, National Vegetable Research Station, Wellesbourne, Warwick. 1959, pp. viii + 55, 3 maps.

See Abstract 2009.

2073 **Republic of Ireland.** Twenty-seventh annual report of the Minister for Agriculture, 1957–58. Dublin, 1959, pp. vi + 176 + append. 82.

See Abstract 1703.

2074 **Kenya.** Land Development Board (Non-Scheduled Areas) [Aldev]. African Land development in Kenya. Report for the financial

year 1st July, 1957 to 30th June, 1958. [n.d.], pp. iii + 97, illus., 1 map. [Received June, 1959]
See Abstract 2028.

2075† **Malaya, Federation of.** Department of Agriculture. Annual report for the year 1956. 1958, pp. 115, illus.
See Abstracts 1786, 1894.

2076 **Australia and New Zealand.** Report of the 33rd Congress of the Australian and New Zealand Association for the Advancement of Science, Adelaide, 1958. [Contained in *Aust. J. Sci.* 1959, **21**, No. 6 and 6a.]
See Abstract 2068.

2077† **International.** Reports of the World Congress of Agricultural Research, Rome, 7–9 May, 1959.
See Abstracts 1801, 1883, 2044.

BOOKS

2078 Ceapoiu, N. Cînepa. Studiu monografic. [**A monograph on hemp.**] 1958, pp. 734, bibl. 486, illus., 21 × 29 cm., Bucharest : Academy of the Romanian Peoples' Republic, Russian and German summaries. [Received May, 1959]

Information on *Cannabis sativa* is given in two sections, the first dealing with the crop in general (12 chapters) and the second with the technical processes for preparing the fibre. The first twelve chapters comprise : (1) History, economic significance and geographical distribution ; (2) Systematics ; (3) Morphology ; (4) Biology ; (5) Biochemistry ; (6) Fibre analysis ; (7) Crop rotation ; (8) Fertilizers ; (9) Cultural measures for the production of fibre alone, seed alone, and for fibre and seed combined ; (10) Diseases and pests ; (11) Breeding ; and (12) Seed production. F. Russ. s. —M.H.

2079 Wolfe, T. K. and Kipps, M.S. **Production of field crops. A text book of agronomy.** 5th edn, 1959, pp. X + 653, bibl. at end of chaps, illus., 23 × 15 cm., London : McGraw-Hill Publ. Co. Ltd.

The 4th edition of this book, published in 1953, was reviewed in *Fld Crop Abstr.* 6 : 1588. The chapters in this revised edition have been rearranged in four groups : Fundamental principles of crop production ; Grain and cash crops ; Forage crops ; Other crops. Some of the chapters have been completely rewritten while others have been combined and expanded. A glossary has been added.—C.L.S.

2080 Schnell, R. Plantes alimentaires et vie agricole de l'Afrique Noire. [**Food plants and agricultural life in Negro Africa.**] 1958, pp. 224, illus., Paris : Éd. Larose, 11, Rue Victor-Cousin. [Seen in *C.R. Acad. Agric. Fr.* 1958, **44**, No. 3 and 5.]

2081† Shell Chemical Company Limited. **Farm weeds. An aid to their recognition.** 2nd edn., 1959, pp. 119, illus., 22 × 14 cm., Shell Chemical Company, Ltd., 10s. 6d.

The control of weeds by herbicides has been one of the outstanding features of progress in farming methods during recent years, but the successful use of chemicals depends, in part, on accurate and early recognition of the weeds to be treated, while they are still in the early stages of growth. This booklet has been designed with the object of helping the farmer to recognize the weeds on his land, so that he can determine the most effective herbicides to use and the rates at which to apply them. This second edition, enlarged and brought up to date, contains 92 colour plates, grouped under : arable weeds, arable and grassland weeds, and grassland weeds. A short description is given of each weed, together with its common and botanical name.—A.G.G.H.

2082† Worthington, E. B. **Science in the development of Africa. A review of the contribution of physical and biological knowledge South of the Sahara.** *Publ. C.C.T.A./C.S.A.* 1958, pp. xix + 462, bibl. 444, illus., 1 map, 24·5 × 16 cm., London and Bukavu : CCTA/CSA, 30s.

This is a successor to *Science in Africa* (1938), completely recast and much more detailed. The sequence of material, from generalities and the physical background to biological and human subjects, is clearly and fairly presented, and well indexed, but more care might have been taken to correct the spelling of scientific names corrupted by dictation. Of the 20 chapters, 9 are devoted to biology and the author makes a special claim on our attention when he refers to the " dearth of generalised accounts of agriculture and farming systems in different parts of Africa " and asserts that " it becomes progressively more difficult to assess the general trends in agricultural progress " (p. 267).

The chapter on Agriculture is a good account, in so short a space, of how traditional practices are evolving towards more advanced systems. It in-

dicates the importance of agriculture to the economy and puts the right emphasis on the need to conserve soil fertility. The supporting chapter on Plant Industry is a useful catalogue of information and achievement. It deals with the origin of crop plants, the place each has taken in the economy, and the research effort devoted to the study of their cultivation and diseases.

There is no separate chapter on herbage, but a useful section on pasture research follows ecology in the chapter on Plant Life. Its emphasis is mainly on veld management and it is rightly stated that "much of the African continent is of value to man primarily for raising stock." But this is not quite the whole story and in the chapter on Agriculture the reference to leys in mixed farming is left rather vague. Is this because no firm conclusions have been reached about the management of leys in Africa? Or is there a lurking doubt about the need for them, because animal manure can be brought onto arable land without them?—J. D. JAMESON.

2083 AUDUS, L. J. **Plant growth substances.** 2nd edn, 1959, pp. 554, bibl. 1545, illus., 24·5 × 15 cm., London: Leonard Hill Ltd., 65s.

Among the subjects discussed in this considerably enlarged and revised edition are: the nature of plant growth and its control; naturally-occurring auxins; the chemistry and mode of action of natural and artificial growth substances; stimulation of growth in crop plants; the prevention and hastening of the fall of leaves and fruits; induction of dormancy in and storage of plant organs; phytotoxicity of growth substances and selective weed control; hormones and plant reproduction; natural and artificial plant growth inhibitors. The book is well illustrated and possesses a glossary, an appendix showing the sensitivities of a large range of weed and crop plants to hormone herbicides, and an excellent subject index. This is a useful and well-prepared reference work.—R.B.

2084† SOCIETY FOR EXPERIMENTAL BIOLOGY. **Utilization of nitrogen and its compounds by plants.** Symposia No. 13, 1959, pp. 392, bibl., illus., Cambridge Univ. Press, 50s.

In this volume are published the 20 papers read by workers from Great Britain, Australia, New Zealand, USA, Germany, Finland, and USSR at the Symposium held at the University of Reading from 15–19 Sept. 1958. The following papers are amongst those presented: Sources of incompatability affecting N fixation in legume symbiosis (P. S. Nutman); Fixation of N in non-legume root-nodule plants (G. Bond); The nature, function and biosynthesis of the haem compounds and porphyrins of legume root-nodules (J. E. Falk and others); Nutritional and environmental effects on the N metabolism of plants (F. C. Steward and others); Assimilation of amino acids in higher plants (Jorma Miettinen); The position of amino acids in the assimilation of N and the synthesis of proteins in plants (B. F. Folkes); Amino acids of plants with special reference to recently discovered acids (L. Fowden); The influence of certain environmental factors on the formation and accumulation of alkaloids in plants (U.S. Sokolov); New perspectives in the biosynthesis of alkaloids (L. Mothes); Nucleic acids and plant growth and development (J. K. Heyes).—D.B.

2085 KOHNKE, H. and BERTRAND, A. R. **Soil conservation.** 1959, pp. vii + 298, bibl. at end of chaps, illus., 23 × 16 cm., London, New York, Toronto: McGraw-Hill Book Co., 52s. 6d.

This book, written as a text book primarily for college students, provides a picture of the fundamental nature and causes of soil erosion, the aims of soil conservation and the methods for saving the soil and maintaining its productivity. The statements are made in the preface that the days of agricultural extension are over and that very little potential farm land remains unused. Those who know Africa will probably agree that these statements do not apply to the vast tsetse-infested areas of that continent, which will become available for agriculture should a solution to the tsetse-fly problem be found.—A.G.G.H.

2086† HAW, R. C. **The conservation of natural resources.** 1959, pp. 256, bibl. 20, illus., 22 × 14 cm., London: Faber and Faber, 30s.

This handbook and practical guide on the conservation of natural resources in dry tropical and subtropical countries is written by an instructor in soil and water conservation at the Domboshawa School in Southern Rhodesia who draws on his experiences in Africa, south-east and central Asia for illustrations of the consequences of soil erosion. The problems of conservation in these countries are world wide and solutions that have been found in Africa can be applied with local modifications by farmers and agricultural officers in all countries with similar problems.

Throughout Africa populations are increasing rapidly and new agricultural techniques and economic demands are upsetting the old methods of agriculture that included shifting cultivation which becomes unsatisfactory when pressure of population makes the fallow period so short that land is insufficiently rested. The chief problem that has arisen is how to deal with the increased demand for land which is rapidly destroyed by primitive cultivation methods associated with wide seasonal and annual variations of rainfall, alternating drought, dust storms and floods.

Mr. Haw contrasts natural or geological erosion with soil destruction caused or accelerated by man and describes, and illustrates with well chosen photographs, the types of erosion resulting

from overstocking, bush encroachment, destruction of trees, grass burning and tillage. For good land use the necessity of farm planning is stressed, with soil surveys and reconnaissance of land and vegetation followed by land classification. The system of classification advocated is based on the eight capability classes used in the United States Soil Conservation Service. Farm planning must be followed by good management and afforestation. Much of the soil is being lost by sheet erosion from the grazing lands which cover most of intertropical Africa and methods of increasing the productivity of grasslands help also to control erosion. Forestry and conservation of forests call for increasing attention in the battle against erosion, runoff and desiccation. Chapters on correct tillage, rotations, leys and strip cropping and conservation of organic matter in the soil are followed by chapters on roads and their construction and drainage, dams and their design and building, water conservation and irrigation, municipal and farm composting, and surveying for contour mapping, irrigation and siting of dams. The book is written for farmers, students and teachers, often stressing the practical side, but reducing technicalities of constructional mathematics and surveying to a minimum. There are 36 photographs in black and white and 35 line diagrams illustrating methods of constructing anti-erosion works. An appendix contains lists of trees, shrubs, grasses and legumes that may be used in conservation measures to hold the soil.

This book should enjoy a wide circulation, not only in Africa. The problems of dealing with increasing populations clamouring for land are as great as are the problems of how to conserve and reclaim eroded soil and these problems must be solved together.—M. K. Milne. [From *Soils and Ferts* 1959, **23**, No. 3, 158.]

2087 Marshall, T. J. **Relations between water and soil.** *Tech. Comm. 50 Commonw. Bur. Soils* 1959, pp. vii + 91, bibl. 357, illus., Farnham Royal : Commonw. Agric. Bur., 20s.

2088 Arléry, R. Éléments de météorologie agricole. [**Elements of agricultural meteorology.**] 1957, pp. 171, bibl. 250, 21 × 27 cm., Paris : Éd. Météorologie Nationale, 196, Rue de l'Université. [Reviewed in *C.R. Acad. Agric. Fr.* 1958, **44**, No. 10]

2089 Department of Economics, University of Bristol. **Farm management handbook, 1958.** 1958, pp. vi + 89, bibl. in text, Bristol University. [Received July, 1958]

This handbook provides a summary of recent financial results that would be helpful to farmers participating in the Farm Management Survey. It also presents a selection of supplementary information that may be of value in planning adjustments to farm businesses. In the final section dealing with economic prospects, recent trends in the production and consumption of agricultural commodities are discussed.—A.M.H.

NEWS AND NOTES

Great Britain

2090 Bracken Control trials in Scotland with weedone brackontrol demonstrated its efficacy in killing both buds and rhizome tips. The effective rate was 1·5 gal. per ac., and the most promising method of application was spraying by helicopter. One treatment given when the fronds were fully expanded, gave 80–90% reduction in bracken growth in the following season. Grass and animals are unaffected by this herbicide which, however, can be harmful to growing crops, heather and trees. *World Crops* 1959, **11**, No. 6, 233.—A.D.H.

USA

2091 A new chemical, 4-hydroxy-5-isopropyl-2-methylphenyl-trimethyl ammonium chloride-l-piperidine carboxylate, known as AMO-1618 is being tested at the USDA Growth Regulation and Antibiotic Laboratory at Beltsville, Maryland. The compound causes some species of plants to grow as dwarfs without otherwise changing their appearance. It is effective on plants when applied to the soil, where it persists for prolonged periods. *Fm Chem.* 1959, 122, No. 1, 31.—R.B.

International

2092 Control of Cotton Pests. The new carbamate insecticide, sevin, has successfully controlled boll weevils and other cotton pests which have acquired resistance to other insecticides. It has low mammalian toxicity, and is stable when properly stored. The recommended rate of application, prior to boll-opening, is 0·5–1 lb. of active material/ac. for early season control of thrips and fleahoppers, and 1–2 lb./ac. for the control of boll weevil, bollworm, aphid, leaf worm, lygus bugs and leaf perforators in mid and late season. *World Crops* 1959, **11**, No. 6, 234.—A.D.H.

Enquiries received

2093 Arising from enquiries answered by the Bureau from March to October 1959, bibliographies on the following were prepared and are available on request from the Director : S.610. Herbicides for rice (21 refs); S.617. Benefits of sprouting seed potatoes (24 refs); S.622. References to barley-growing in the tropics (49 refs); S.640. Groundnuts, effects of spacing and plant population on crop yield (13 refs).—C.L.S.

ANNUAL SUBJECT INDEX, VOL. 12, 1959

References are to abstract numbers. R.A. = Review article. * = Title only.

Abutilon theophrasti — see also under Weeds
germination, 920
Acacia sp. — see under Weeds
Acalypterae, 1607*
Actinomyces scabies, 1849
Acyrthosiphon pisum, 743, 747
Adenium spp. — see under Weeds
Aelia spp., 710
Afghanistan
land use, 431
rice, 659, 660*
Africa
agriculture, 2080*, 2082
climate, 476*, 1075
crops
cereals, nomenclature, 151
cotton, 1048
legumes, use of, 1076
East
agricultural research, 1020, 1619*
flora, 524
ecology, 1634
farming systems, 2082, 2086
flora, atlas, 1075
phyto-sanitary specialists, list of, 503*
plant associations, nomenclature, 1634
science in, 2082
soils, map, 1634
vegetation, maps, 1567, 1634
weeds of, *Eichhornia crassipes*, 1075
West
agric. research workers, 1023*
flora, 525
Afzelia africana, 1579
Agave sp. — see under Weeds
A. toumeyana, growth substance from, 371
Agelaius phoeniceus, 1753
Agricultural economics, 1615
climate/soil factor, 2065
farm management studies, Gt Britain, 2089
farm profits, S.E. England, 1001
in Denmark, 1003
in Gt Britain, 504*, 1001, 1002, 2089
in India, W. Bengal, 425
in Norway, 1003
rice production, N. Malaya, 700
Agricultural labour in India, W. Bengal, 425
Agricultural mechanization, 505* — see also Machinery
in Formosa (Taiwan), 443*
in Italy, 961
Agricultural meteorology, 2088* — see also Climate, Micrometeorology and Weather
and windbreaks, 2055
dew point and altitude, 986
drought probability, Sweden, 2051*
estimations, agroclimatic, from thermal factor, 987*
growing season definition, 1603*
humidity
measurement, 484
world records, 476*, 2056*
precipitation, world records, 476*, 2056*
rainfall
intensity, frequency analysis, 475
probability, Sweden, 2051*
temperature
and agroclimatic estimations, 987*
and dew point relationship, 986
and world relative humidity records, 476*
recording, ground level, and winter-hardiness studies, 2050
underground, and slope inclination, 472
world records, 476, 2056*
water vapour pressure, atmospheric, world atlas, 1601
world data, 1638
Agricultural production, 500*
Agricultural research
and farming, 540*
and radioisotopes, 1523
in Belgian Congo, Kivu, 1079
in Brit. Commonwealth, 502
in E. Africa, 1020, 1619*
in USSR, 484
workers, W. Africa, 1023*
Agricultural statistics, 2067
in Gt Britain, 999*
Anglesey, 950
Agricultural survey, in India, W. Bengal, 425
Agriculture — see also Farming systems
and atomic energy, 1522*
FAO census 1958, 485*
history of, 520
in Africa, 2080*, 2082
in Angola, 519
in Argentina, 2024, 2025
in Belgian Congo, Bashi region, 423
in Belgium, 1565*
in Brazil, 428, 1614*
in Canada, 1602, 1564
in Czechoslovakia, 1640*
in Formosa (Taiwan), 1574*
in Gilbert Is., 427
in Gt Britain, 430*, 1055*
Anglesey, 950
Yorkshire, small farms, 2018*
in India, 1057, 1568*
in Italy, Pavia Prov., 421
in Madagascar, 958, 1566
in Morocco, Souss Plain, 422
in New Guinea, Chimbu, 426
in Poland, 2020*
in Port. Guinea, 424*
in Sarawak, Iban, 518
in Spain, 2019
in Tanganyika, 1633
in USSR, 429
Agriotes spp., 255, 561, 1017, 1379, 2060
Agropyron elongatum, 1798
A. repens — see also under Weeds
bud dormancy, 906, 908, 1530*
leachate, effect on crop growth of, 2010
rhizome growth and light intensity, 905
Agrostis tenuis, 1115
Agrotis infusa, 839
A. ypsilon, 1381
Aircraft, use of,
for herbicide spraying, 1234
for sowing, rice, 1084
Albizzia spp. — see under Weeds
Alca spp. — see under Weeds
Alfalfa — see Lucerne
Algeria
potatoes, 230
rice, in Oran, 1223
Alisma spp. — see under Weeds
Alkaloids, in plants, 1500
Almus glutinosa, N fixation, 1469
Alopecurus aequalis — see under Weeds
Alternaria linicola, 1447
A. solani, 1366
Amaranthus spp. — see under Weeds
A. retroflexus — see under Weeds
Ambérique — see Beans, *Vigna mungo*
Ambrosia artemisiifolia — see under Weeds
Ammi spp. — see under Weeds
Andropogon gayanus, 1579
Angola, agriculture, 519
Anguillulina tritici, 17
Anomis flava, 839
A. sabulifera, 858
A. texana, 1434
Antarchaea chionosticta, 839
Antarctica, climate, data, 476*
Anthonomus grandis, 1432
Anthracnose — see *Colletotrichum hibisci*
Antibiotics
agromycin, 1385
dihydrostreptomycin, 1375
streptomycin, 1375, 1385, 1862
xanthozillin, 1956
Aphids, 223, 257 — see also *Acyrthosiphon pisum*, *Aphis* spp., *Brevicoryne brassicae*, *Myzus persicae*, and *Rhopalosiphum pseudobrassicae*
Aphis spp., 195, 837
A. fabae, 215, 742, 743, 744, 1816
A. gossypii, 313
Aphthona euphorbiae, 331
Apion corchori, 858
Apparatus
centrifuge, wheat ear-shedding measurement, 31
drying-oven, crop samples, 1506
evapotranspiration measurement, 990 — see also lysimeters below
growth chamber, field, 898 — see also phytotron below
interval-timer, for isotope research, 897
lamps for supplementary lighting, 896

leaf-area measurement, 1505, 1982
lysimeters, 473, 991, 992, 1518, 1600, 1735
photosynthesis-intensity measurement, 1512
phytotron, 1984*, 1985
plant culture, 375, 1514*
porometer, 895
rice grain, suncracking determination, 694
seed-counter, 1502
soil moisture gauge, 1517
soil thermometer, 385*
sprayer, logarithmic, 1563
tags, plant marking, 1987
thermistor, humidity measurement, 484
thermostat
air-temperature, 1516*
for germination trials, 377
X-ray, 1513
Arachis spp., chromosome number, 176*
A. hypogaea — see Groundnuts
Arboricides — see Herbicides
Argentina
agriculture, 2024, 2025
climate, 2024, 2025
crops
barley, varieties, 61*
cotton, 320, 2025
oats, varieties, 41*
peas, 186
rye, varieties, 50*
sugar-beet, Buenos Aires, 1339
irrigation, 2024
land use, 432, 951
Solanum spp., nomenclature, 1881*
Argyroploce sp., 1441 (2)
Arhar (*Cajanus cajan*) — see Pigeon peas
Arid regions, 521
in USSR, 1593
psammophytes as indicators, 1526
weed control in, 1554
Armyworm — see *Leucania unipuncta*
Arrhenatherum elatius, 1975
Artemisia spp. — see under Weeds
Ascochyta linicola, 850
Asia, climate, data, 476*
Asphodelus tenuifolius — see under Weeds
Atherigona spp., 674
Athous haemorrhoidalis, 1017
Atomic energy — see Nuclear energy, Irradiation, Radioisotopes, Radioactive fallout, and Radioactive waste
Atriplex semibaccatum, and soil stabilization, 1599
Australia
climate, data, 476*
land development, 2068*
plant introduction, 2068*
potato industry, 1892
seed exchange, 1083
soil erosion, in mountain catchments, 983
States and Territories
New South Wales
crops
arable, for silage, 1275
maize, 1719
oats, 1687
safflower, 1456
Hume catchment
climate, 1598
geology, 1598
soil conservation, 466*, 1598
Northern Territory
climate, 483
crops, 483
groundnuts, 724
sorghum, 724
Queensland
safflower, 1456
sorghum, for silage, 1210
Western
farming systems, 540*
fibre flax, 1443, 1444
land development, 1573*
Austroasca spp., 839
Autoradiography, 387
Avena spp. — see also Oats and under Weeds
growth-inhibiting substances in, 911
nomenclature, 1281
root-hair growth and xanthozillin, 1956
seed dormancy and GA, 912
xanthozillin, effect of, 1956
A. alba, 593
A. byzantina, 593
A. fatua, 593 — see also under Weeds
germination, 393, 2000
A. longiglumis, 593
A. ludoviciana, 593 — see also under Weeds
A. pilosa, 593
A. sativa — see Oats
A. sterilis, 593
A. strigosa, 593
P content, 45
A. strigosa × *brevis*, 45
Avicennia nitida — see under Weeds
Azotobacter and germination, 1943
Bacillus thuringiensis, 1643
Bambarra groundnuts (*Voandzeia subterranea*), 1631
in Fr. overseas territories, 746
in Kenya, 202
Barley (*Hordeum* spp.)
for fodder
as silage, 1275
harvesting date, 1275
plant population, 54
seed rate, 54
spring, grown in winter and irrigated, 1134
for grain
climate and protein content, 798
clipping and yield, 55
competition, effect of, 1160 — see also plant population and weeds below
diseases
Erysiphe graminis, 62
Gibberella zeae, 62
Helminthosporium gramineum, 1152
Ustilago sp., 1711*
U. hordei, 591
U. nuda, 1154
drought, effect of, 609
drought resistance, 66, 365
drying, 588
ear(s)
branching and light, 713
dry weight and yield, 65
formation, 69, 1119
nutrient translocation during, 129
number of, and fertilizers, 715
photosynthesis and kernel development, 1157
shading and kernel development, 1157
size and yield, 65
X-ray observation of, 1513
fertilizers, 52, 54, 56, 65, 71*, 158, 608, 714, 715, 1164*, 1165, 1287, 1564, 1613, 1717*, 1718, 1798, 2038
flowering
and heat damage, 1284
and light quality, 154, 380
and photoperiod, 154
grain
chemical composition, 1272
N content, 586, 1717*
protein content, 707, 797, 798, 1718
protein metabolism, 1067
damage by harvester, 1166
diastase activity and fertilizers, 1718
drying, 161, 1167
kernel development and CO_2, 1157
number, 586
and drought, 609
and fertilizers, 715
and heat damage, 1284
quality, 56, 60 — see also malting below
size
and drought, 609
and sowing date, 586
water sensitivity, 1712
weight
and fertilizers, 715
1000-grain wt, 702, 1150
growth
and drought, 609
and seed size, 702
growth substance extracted during malting, 1713
growth substances, GA, effect of, 1162
harvesting
combine-, 1707, 1166, 1716
damage, 604, 1166
swath-, 588, 1707
harvesting date, 702
herbicides, effect of, 949
in Ethiopia, highlands, 657
in mountain areas, varieties, 1277
irradiation, effect of, 1521
irrigation, 56, 1586
leaf-area index and yield, 65
light intensity, effect of, 1119
light quality, effect of, 154, 713
malting, 56, 604, 606, 797, 798, 1166, 1710, 1712, 1713, 1718
photoperiodism, 154, 1513
and ear branching, 713
and supplemental light, 380
photosynthesis and yield, 65
plant population and sowing date, 1150
rainfall and yield, 1790
root excision and ear formation, 69
rotations, 2038
seed rate, 1710
seed size and plant growth, 702

sodium, exchangeable, tolerance to, 1798
sowing date, 53, 1150
spikelet(s)
development and fertilizers, 1164*
sterile, 608
stem(s)
fruitful, no. of, and seed-bed preparation, 586
internode length and spikelet sterility, 608
storage, 611, 612, 1166
temperature, effect of, 1790
heat damage, and flowering, 1284
tillering and sowing date, 1150
undersown, 603
general
as cover crop, on saline soil, 467
branching, aerial, and detillering, 688
chemical composition
Mn localization, 1968
protein metabolism, 1067
cold resistance and DNC, 1285
cropping, mixed, 210
cultivation, 1047, 1080
and soil moisture, 365
ploughing date and weed control, 709
ploughing depth and ^{32}P uptake, 70
detillering, effect of, 688
diseases, 1016, 1047
seed-borne, 2057
dry weight and sowing date, 1150
drying, 161
fertilizers, 139, 365, 1047, 1080, 1161, 1499*
and frost resistance, 1800
frost, effect of, 702
frost resistance, 1800
growth substances
effect of
rindite, 607
2,3,5-triiodobenzoic acid, 1490
2,3,6-TBA, 1490
2,4-D, 1490
2,6-dichlorobenzoic acid, 1490
translocation of, TIBA, 1491
harvesting date, 1707
herbicides, effect of,
CDAA, 910
dalapon, 414
DNC, 1285
IPC, 910
MCPA, 67, 1489
simazin, 1730
TBA, 2005
2,4-D, 67, 1163, 1489
H. distichon, 688
H. trifurcatum hexastichum nigrum, 1119
in Africa, nomenclature, 151
in Gt Britain, 1047
in India, 1080
in Morocco, Souss Plain, 422
in USA, N. Dakota, 704*
irrigation, 1080
leaf, amino acids in, 1714*
light quality and growth, 380
micronutrients, effect of, 358—see also fertilizers and nutrition
Mn deficiency, varietal susceptibility to, 596
Mo deficiency, 495
nutrient uptake, 1159*, 1161, 1492
nutrition, 610, 1714*, 1959
and tracer-element uptake, 1991
on peat-land, 1278
on reclaimed land, 437
on saline soil, 438, 467
^{32}P, effect of, 1715*
^{32}P uptake, 70
pests, 1047, 1080
Ditylenchus dipsaci, 592, 1139
photoperiodism, 1672, 1947
plant population, 1483
pollination studies, 153
root(s)
cation-exchange capacity, 1959
development and soil aeration, 365
formation, 1158
rotations, 969, 1582
seed
chemical composition, Mn localization, 1968
damage and germination, 1716
dormancy, 1156
breaking, 607, 706
germination, 1168
and protein metabolism, 1067
and water sensitivity, 1712
of damaged seed, 1716
percentage and sowing date, 1150
testing, 1155
size, 1090
ultrasonic vibration, effect of, 63, 68
viability, duration of, 351
seed-bed preparation, 586, 1158, 1799
seed production
and detillering, 688
and harvesting date, 702
seed rate, 210, 1706*
seed storage, 580, 1168, 1288
seed treatment, 63, 68, 1080, 1154, 1288
and drought resistance, 66
seedling
geotropism and growth substances, 1490
root formation, 1158
shoot(s)
tracer-element content and nutrition, 1991
soil acidity
effect of, 1286
resistance to, 1160
sowing date, 1080, 1090, 1150
sowing method, 1047
stem growth and light quality, 380
straw, ploughed-in, effect of, 2038
varieties, 482, 703, 797, 1080, 1278, 1630, 1708
and altitude, 705
in Argentina, 61*
in Gt Britain, 1047, 1151
in Kenya, 1279
in Norway, 1277
in Turkey, 60
in USA, N. Carolina, 1792
in USA, N. Dakota, 704*
specific
Abed Kenia....603
Abed Mentor....1098
Alfa....1139
Ardennes....59
Åsa....1277
Atlas....59, 596
Bachué....606
Balder....1709, 1710
Beecher....596
Beka....59, 605
Beorna....58, 148
Bonus....58, 1276
Busser....59, 1156
Carlsberg....1709, 1710
Carlsberg II....59, 592, 605, 1151
Colsess I....380
Dea....1152
Delta....1709
Dicktoo....57
Domen....605, 1156
Drost....1139
Earl....1151
Fero....1139
Firlbeck I....1152
Fløya....1277
Freja....1151, 1276
Funza....606, 1153
Glasnevin No. 3....1708
Hatif Bonté....59
Hauters Wintergerste....1152
Herta....54, 65, 148, 1151, 1710, 1791
Ingrid....605, 1708
Isaria....59
Jotun....1277
Kearney....57
Kenia....605, 1156, 1710
Kido....57
Kran....1139
Kron....592
Kungs (Pajbjerg Drost)....592
Maskin....1277
Maythorpe....58, 1151
Minerva....1709
Montcalm....56, 1718
Nakate-Hadaka....62
Newal....1564
Nutans 187....66
O.A.C. 21....1718
Olli....1564, 1718
Pajbjerg Drost....592
Pioneer....1151
Pirol....1708
Plumage-Archer....65, 1151
Proctor....58, 65, 148, 158, 1151, 1276, 1708, 1710, 1791
Provost....58, 1151
Research....9
Rika....158, 1151, 1276
Riniker....1152
S.A.K. 17/8....148
S.A.K. 17/9....148
S.A.K. 22/8....148
S.A.K. 22/11....148, 1708
S.A.K. 33....148
S.A.K. 54....148
S.A.K. 95....148
S.A.K. 102....148
S.A.K. 104....148
S.A.K. 115....148
S.A.K. 131....148

S.A.K. 139....148
Spratt Archer....586, 1151
Tequendama....606
Tobak 157/37....60
Varde....1277
Wisa....605
Ymer....58
water balance, factors affecting, 365
weeds in, 559, 707, 1080
and ploughing date, 709
specific
Agropyron repens, 708
Avena spp., 707, 910
A. fatua, 1540, 2000
Brassica arvensis, 707
Cardaria draba, 936
Centaurea repens, 936
Convolvulus arvensis, 936
Cirsium arvense, 936
Euphorbia esula, 936
Polygonum convolvulus, 707
P. lapathifolium, 64, 1009, 1548
Sonchus arvensis, 936
winterhardiness, 57, 1283
Barnyard grass — see Weeds, *Echinochloa crus-galli*
Bathurst burr — see Weeds, *Xanthium spinosum*
Bavaria, land reclamation, 1004
Beans — see also Jack beans and Sword beans
general
cross-inoculation group, 749
cultivation, 1056
drying, in-sack, 2064
fertilizers, 1056
growth substances, effect of, 1954
harvesting, 1056
herbicides, effect of, 2014
Mn localization, 1968
rotations, 1907
seed
extract and rice-plant growth, 1777*
Mn localization in, 1968
seed-bed preparation, 1056
seed treatment, 1074
sowing, 1056
storage, 2064
^{90}Sr uptake and soil Ca, 1988
weeds in, 2014
Phaseolus spp., 1631
interplanting, 657
root, absorptive and excretory activities, 1938
weeds in, *Cyperus esculentus*, 395
Ph. angularis, inoculation, 1331
Ph. aureus
B deficiency, 1495
B content, protoplasm, 1495
cropping, mixed, 1210
nutrition, 1495
Ph. lunatus, in Madagascar, 746
Ph. multiflorus, growth and light intensity, 1476
Ph. mungo
as green manure, 598
cropping, mixed, 1210
intercropping, 1597
Ph. radiatus, varieties, 717
Ph. vulgaris
dry weight and light intensity, 1478
flowering and light, 1478
growth and light, 1478
growth substances, xanthozillin, effect of, 1956
herbicides, 2,4-D, effect of, 1555
in Madagascar, 746
leaf
chem. comp. and light, 1478
nutrition, 392
light intensity, effect of, 1478
light quality and growth, 1478
nutrient translocation, 392
nutrient uptake, 392
nutrition, 1988 — see also under leaf above
plant population and light intensity, 1478
root
chem. comp. and 2,4-D, 1555
-hair growth and xanthozillin, 1956
seed, chem. comp. and light quality, 1478
var. Triumph . . . 1478
Vicia faba, 1631
B deficiency, 1958
cropping, mixed, 193, 741
diseases, 193
fertilizers, 1613
growth
and light intensity, 1476
and water stress, 1351
growth substances, MH, effect of, 872
herbicides, effect of,
MCPB, 949
simazine, 2009
in Gt Britain, 193
insecticide toxicity to bees on, 2062
insecticides, effect of, 2058
light intensity, effect of, 1476
net assim. rate and light intensity, 1476
nutrition, 1958
pests, 193, 2058
Acyrthosiphon pisum, 743
Aphis fabae, 742, 743, 744, 1816
phloem, 1818*
plant population, 194, 1816
pod-filling and spacing, 194
radicle growth, and B, 1958
root(s)
fermentation in, bacterial, 1817*
geotropism, 1945
growth substances in, 1945
rotations, 2043
seed
protein content, 1333
1000-seed weight and spacing, 194
seed production, 194
seed rate, 194, 740
seed treatment, 2058
spacing, 194, 740
tillering and plant pop., 194
types in Gt Britain, 193
varieties
Allenvroegste [Earliest-of-all]....194
Rastatter....742, 743, 744
Schlanstedter....742, 743, 744
Verbeterde Witkiem [Witkiem Improved]....194
water stress, effect of, 1351
weeds in, 2009
V. faba equina
for forage, 195
seed production, 195
varieties, 195
V. faba var.
photosynthesis and ozone, 1464
respiration and ozone, 1464
V. faba var. *major*
seed, chem. comp., 1822
V. faba var. *minor*
for forage, 195
seed production, 195
varieties, 195
Vigna mungo, 1325
Bees, 1608, 2062
Belgian Congo
agricultural research, in Kivu, 1079
agriculture, Bashi region, 423
climate, 998*
flora, 1053, 526*
hail storms in, 2052*
irrigation, 972
land use, 1571
potatoes, 1363
soils, 1571
sweet-potatoes, Elizabethville region, 287
Belgium
agriculture, 1565*
rye varieties, 1285
sugar-beet, 1344*
weeds, 2006
Bemisia tabaci, 1430
Benniseed (*Sesamum indicum*) — see Sesame
Bergenia crassifolia, 359
Bermuda grass — see *Cynodon dactylon*
Berseem clover — see Clover, *Trifolium alexandrinum*
Beta spp., effect of gibberellin on, 874
B. vulgaris — see also Fodder-beet and Mangels
seedling identification, 1346
B. vulgaris var. *saccharifera* — see Sugar-beet
Bibliographies
cotton, plant density and yield, 1089*
land reclamation of mined areas, 955
plant protection, 1948–9, 531*
vetch, *Vicia sativa*, 1089*
weed seed depth and germination, 1089*
Bidens sp. — see under Weeds
Bindweed — see Weeds, *Convolvulus arvensis* and *Polygonum convolvulus*
Bird repellents, 1753
Birds, excretion of seeds by, and seed viability, 2008
Black medick (*Medicago lupulina*), 1924, 1925, 2008
Blackarm disease — see *Xanthomonas malvacearum*
Blaniulus guttulatus, 1343
Boat-tailed grackle — see *Cassidix mexicanus major*
Boll weevil — see *Anthonomus grandis*
Bollworm — *see Heliothis zea* and *Pectinophora gossypiella*
Bonavist beans — see *Lablab niger*
Books
Arléry, R. [Elements of agricultural meteorology], 2088*

Ass. Étude Taxon. Flore Afr. Trop. Vegetation map of Africa south of the Tropic of Cancer. Explanatory notes, 1634
Audus, L. J. Plant growth substances, 2083
Aufhammer, G. Barley varieties — EBC, 1630
Bärner, J. Bibliography of plant protection. 1948–49, 531*
Black, C. A. Soil-plant relationships, 527
Bristol Univ., Dep. Econ. Farm management handbook, 1958, 2089
Brown, C. H. Cotton in British Guiana, 825
Ceapoiu, N. [A monograph on hemp], 2078
Choudhuri, H. C. Potato in West Bengal, 515
Clapham, A. R. Flora of the British Isles. Illustrations. Pt 1. Pteridophyta — Papilionaceae, 1052
Conklin, H. C. Hanunóo agriculture. A report on an integral system of shifting cultivation in the Philippines, 517
Cowie, G. A. Potash. Its production and place in crop nutrition, 529
Duckham, A. N. The fabric of farming, 520
Ernould, L. and van Steyvoort, L. [Atlas of pests and diseases of sugar-beet], 1632
Extermann, R. C. Radioisotopes in scientific research. Vol. 4. Research with radioisotopes in plant biology and some general problems, 1058*
FAO. Tabulated information on tropical and subtropical grain legumes, 1631
Frear, D. E. H. and others. [Eds.] Pesticide handbook 1958, 533
Freeman, J. D. Iban agriculture, 518
Gill, N. T. and Vear, K. C. Agricultural botany, 522
Guerra, P. R. A. and others. [Memoirs. Tropical agronomy series. 3. General survey of agriculture, forestry and livestock in the zones of influence of the Mossamedes railway between Serpa Pinto and the east frontier (north and south branches) (Angola)], 519
Haw, R. C. The conservation of natural resources, 2086
Hey, G. L. and Marshall, K. The control of pests and diseases in agricultural and horticultural crops, 1049
Hine, H. J. Machines on the farm, 1064*
Hutchinson, J. and Dalziel, J. M. Flora of West Tropical Africa, 525
István, I'só. [Ed.] [Cultivation trials with maize], 516
Kohnke, H. and Bertrand, A. R. Soil conservation, 2085
Lhoste, J. [Chemical herbicides], 1051
Martin, H. Chemical aspects of ecology in relation to agriculture, 523
Martin, H. The scientific principles of crop protection, 1050
Minist. Agric., Fish., Fd. England and Wales. Manures and fertilizers, 1061*
Pearson, E. O. Insect pests of cotton in tropical Africa, 1048
Randhawa, M. S. Agriculture and animal husbandry in India, 1057
Roy. Comm. Common Ld, England and Wales. Report 1955–8, 1636
Sanders, H. G. An outline of British crop husbandry, 1056
Schilling, G. [Magnesium, a universal plant nutrient], 1635
Schnell, R. [Food plants and agricultural life in Negro Africa], 2080*
Shell Chem. Co. Ltd. Farm weeds. An aid to their recognition, 2081
Singleton, W. R. Nuclear radiation in food and agriculture, 528
Soc. Exp. Biol. Utilization of nitrogen and its compounds by plants. Symposia. No. 13, 2084
Steward, A. N. Manual of vascular plants of the Lower Yangtze Valley, China, 1054
Turrill, W. B. and Milne-Redhead, E. Flora of tropical East Africa. Rhizophoraceae ; Menispermaceae, 524
UNESCO. Adv. Cttee Arid Zone Res. Arid zone research. 9. Guide book to research data for arid zone development, 521
U.N. Terminology Section. Atomic energy, glossary of technical terms, 1059*
Weickmann, H. and Smith, W. [Eds.] Artificial stimulation of rain. Proceedings of the 1st Conference on the Physics of Cloud and Precipitation Particles. Mass., Sept., 1955, 530*
Wolfe, T. K. and Kipps, M. S. Production of field crops. A text book of agronomy, 2079
Worthington, E. B. Science in the development of Africa. A review of the contribution of physical and biological knowledge South of the Sahara, 2082
Yapp, W. B. and Watson, D. J. [Ed.] The biological productivity of Britain. Symposia of the Institute of Biology, No. 7, 1055

Boron (review), 885 — see also fertilizers and nutrition under indiv. crops
Botrytis sp., 223
B. cinerea, 850, 1447
Brachystegia sp. — see under Weeds
Bracken — see Weeds, *Pteridium* sp.
Brassica spp. — see also under Weeds
  chemical ploughing, 980
  gibberellin, effect of, 874
B. arvensis — see under Weeds
B. campestris — see Sarson and Toria
B. campestris var. *oleifera* — see under Rape
B. crenata, 1465
B. hirta — see under Weeds
B. juncea — see under Mustard
B. napus — see Rape
B. napus var. *napobrassica* — see Swede-turnips
B. napus var. *oleifera* — see under Rape
B. nigra — see under Mustard
B. oleracea, identification, 1993 — see also Kale
B. oleracea var. — see Chou moellier
B. oleracea var. *capitata*, surface structure studies, 1511
B. rapa — see Turnip
B. tournefortii — see under Weeds
Brazil
  agriculture, 428, 1614*
  crops
    cassava, 298
    cotton varieties, 309
    maize, Rio Grande do Sul, map, 1169
    rice, 111, 1271*, 1761
    wheat, varieties, 8
  farming systems, in Rio Grande do Sul, 2030*
  land use, in Rio Grande do Sul, 2030*
  soil quality and plant indicators, Rio Grande do Sul, 1612*
British Commonwealth
  agric. research organizations, 502
  land use, 1569*
British Guiana
  cotton, 825
  Mahaicony-Abany Rice Scheme, 1224
Bromus inermis, 936
B. mollis, 2008
B. secalinus — see under Weeds
Broom corn (*Sorghum* sp.)
  harvesting, 1212
  in Mexico, 1212
  varieties, 482, 1212
Broom millet — see Broom corn
Broom rape — see Weeds, *Orobanche ramosa*
Bruchus lentis, 200
Buckwheat (*Fagopyrum esculentum*)
  as smother-crop, 936
  chem. comp., Mn localization, 1968
  drought resistance and micronutrients, 358
  dry-matter content and stand density, 1686
  growth substances, effect of, GA, 585
    xanthozillin, 1956
  leaf area, total, and stand density, 1686

micronutrients, effect of, 358 — see also fertilizers above
net-assim. rate and stand density, 1686
photoperiodism and pistil growth, 584
root-hair growth and xanthozillin, 1956
seed, Mn localization in, 1968
spacing, 1686
stand density, 1686
Buffalo burr — see Weeds, *Solanum rostratum*
Bulrush millet — see Millets, *Pennisetum typhoideum*
Burma, second-crop growing, Irrawaddi delta, 1225
Burning — see under Farming systems
Busseola fusca, 86
Cajanus spp. — see Pigeon peas
Caladium bicolor — see under Weeds
Calandra spp., 1202
C. oryzae, 651, 658, 1201
Californian burr — see Weeds, *Xanthium californicum*
Calopogonium mucunoides, 451
cross-inoculation, 749
Camelina sp. — see also under Weeds
C. sativa
harvesting date, 869
oil, chem. comp., and harvesting date, 869
shedding, 869
Canada
agricultural statistics, 2067
agriculture, 1564, 1602
climate
and agriculture, 1602
of B.C., 996*, 997*
of Yukon, 996
of cent. Canada, 995*
crop yields, Yukon, 1564
rape, 347
tree-shelter research, 448
wheat, varieties, 6
Canada thistle — see Weeds, *Cirsium arvense*
Canavalia ensiformis — see Sword beans
C. gladiata — see Jack beans
Cañihua (*Chenopodium pallidicaule*), 1272
Cannabis sativa — see Hemp
Cape tulip — see Weeds, *Homeria* spp.
Capsicum spp. — see Pepper
Cardaria draba — see under Weeds
Carduus acanthoides — see under Weeds
C. nutans var. *macrocephalus* — see under Weeds
C. pycnocephalus — see under Weeds
Carthamus lanatus — see under Weeds
C. oxycantha — see under Weeds
C. tinctorius — see Safflower
Carum ajowan, 1546
Cassava (*Manihot utilissima*)
cuttings, propagation of, 299
diseases, mosaic, 1411
growth substances, effect of, 299
harvesting, 302, 1410
in Brazil, 298
in Kenya, 302
intercropping, 1421
planting method, 813
seed rate, 302
spacing, 302
Cassia spp., root excretions, 748
Cassidix mexicanus major, 1753
Catch crops, in E. Germany, 236, 2041
Centaurea spp. — see under Weeds
Centrosema sp., inoculation of, 1330
C. plumieri, root excretions, 748
C. pubescens, cross-inoculation, 749
Cephus cinctus, 1112
Cercospora sp., 1311
C. beticola, 213, 763
Cercosporella herpotrichoides, 711, 1660
Cereals — see also individual crops
anti-fungal substances in, 889*
clipping, effect of, 159
cold resistance, 1285, 1796
cropping, mixed, 193
cultivation, 1056
ploughing date and weed control, 709
diseases
root rots and rotations, 711
seed-borne, 150
drying, 161
fertilizers, 159, 1056, 1286, 1291
grain
drying, 161, 162, 1289, 1290*
moisture content determination, 1506, 1986
quality
and insecticides, 1610
and K, 1494
and temperature, 1286
harvesting, 1056
technique, in field experiments, 1011
herbicides, effect of, 734, 949
CP18-15, 2015
dalapon, 949
DNC, 1285
4-(MCPB), 2014
MCPA, 401, 2015
MCPB, 949
neburon, 921
TBA, 2015
2,4-D, 401, 2015
2,4,5-TP, 949
2-(2,4,5-TP), 2014
2-(MCPP), 2014
in Africa, history of, 151
in Canada, distribution, 1602
insecticides and crop quality, 1610
K deficiency and grain quality, 1494
pests, 164, 165, 1607*
Aelia spp., 710
Agriotes lineatus, 1017
A. obscurus, 1017
A. sputator, 1017
Athous haemorrhoidalis, 1017
Eurygaster spp., 710
Heterodera major, 1280
Leucania unipuncta, 127
Persectania ewingii, 488
Talis pedionoma, 712
photoperiodism, 1286
and cold resistance, 1796
production, world, 1801
reproductive organs, ontogenesis of, 1795*
rotations and disease control, 711
seed
dormancy, 156, 1794
breaking, 706
germination testing, 1116, 1282*, 1793, 1794
seed-bed preparation, 1010*, 1056
seed certification, Nr East, 149*
seed treatment, 150, 1017
and germination tests, 1794
fungicide/micronutrient, 155
soil moisture, effect of, 1797*
sowing, 1056
spacing, 145
storage, 163, 164, 165, 505*, 716, 901, 1069
straw
analysis and SiO_2 content, 157
ploughed-in, effect of, 2038
tags for labelling, 1987
temperature, effect of, 1286
varietal trials, between-trials error, 1802
varieties, 146
in Gt Britain, 1291
in USA, Indiana, 147*
weeds in, 401, 734, 1550, 1553, 2014, 2015
and ploughing date, 709
specific
Avena fatua, 2000
Rumex spp., 1537
Tussilago farfara, 949
winter-, grazing of, 1273
yield estimation, 160
Ceuthorhynchus spp., 1462
Ceylon
rice, seed prod. and distribution, 1762
soil and water conservation, 1554, 1592*
weeds, 1554
Chara spp. — see under Weeds
Chasmanthe aethiopica — see under Weeds
Chatri-matri — see *Lathyrus sativus*
Chelating agents and plant nutrition, 1498*
Chemical ploughing — see under Farming systems
Chenopodium album — see under Weeds
C. cordobense — see under Weeds
C. hircinum — see under Weeds
C. murale — see under Weeds
C. pallidicaule — see Cañihua
C. quinoa — see Quinoa
C. rubrum — see under Weeds
Chickpeas (*Cicer arietinum*), 1631
cultivation, 1080
fertilizers, 1080
harvesting, 202
in India, 1080
in Kenya, 202
irrigation, 1080
pests, 1080
rotations, 109, 1921
seed rate, 202
seed treatment, 1080
sowing date, 1080
spacing, 202
varieties, 1080
weeds in, 1080
Chickweed — see Weeds, *Stellaria media*
Chile, wheat and fertilizers, 38
China
flora, of Lower Yangtze Valley, 1054
jute, in North, 335
Chironomus thummi, 1238
Chlorella sp., irradiation, effect of, 1520
Chloris sp., before cotton, 821
C. gayana, 968, 976, 1907
Chlorophyll determination — see under Plant(s), analysis

Chondrilla juncea — see under Weeds
Chou moellier (*Brassica oleracea* var.), weeds in, 764
Chrysanthemum segetum — see under Weeds
Cicer arietinum — see Chickpeas
Cirsium arvense — see also under Weeds
seed germination, 916, 918
C. vulgare — see under Weeds
Climate — see also Agricultural meteorology, Micrometeorology and Weather
and crops
barley, protein content, 798
cotton, 1435
maize, 623, 1726, 1739, R.A. p. 169
millet, *Setaria italica*, 1757
potatoes, seed production, 1874
rye, 1705*
sweet-potatoes, transpiration, 809
wheat, 30, 1126
and irrigation needs, 474
of Africa, atlas, 1075
of Argentina, 2024, 2025
of arid regions, 521*
of Australia, 483
N.S.W. Hume catchment, 1598
of Belgian Congo and Ruanda-Urundi, 998*
of Canada, 1602
B.C., 996*, 997*
central, 995*
Yukon, 996*
of French Oceania, 952
of Gilbert Is., 427, 481
of Gt Britain, maps, 1060*
of India, 1057, 1591
of Madagascar, 1566
of New Zealand, 994*
of Norway, Ås, 480
of São Tomé and Principe Is, map, 2021
of USSR, 2053*
precipitation, world data, 476*
relative humidity, world data, 476*
/soil complex, in France, 2065
temperature, world records, 476*
water-vapour pressure, atmospheric, 1601
Clover (*Trifolium* spp.)
cross-inoculation group, 749
defoliation, 2013
light intensity, effect of, 1476
Mo deficiency, 495
net-assim. rate and light intensity, 1476
soil fumigation, effect of, 1606
T. alexandrinum, rotations, 109, 1921
T. fragiferum, on saline soil, 467
T. pratense, 1924
and barley nurse crop yield, 603
herbicides, effect of,
dinoseb, 1925
DNC, 1925
MCPP, 949
S deficiency, 883
seed viability, 351, 2008
winterhardiness, 1481
T. repens
/*Festuca pratensis* mixture, and following crop, 1582
growth substances, gibberellin, effect of, 1486
herbicides, dalapon, effect of, 414
nodulation and gibberellin, 1486
seed viability, 351, 2008
undersown in wheat, and following crop, 1582
T. resupinatum, 1908
as green manure, 1908, 1910*
T. subterraneum
and earthworm populations, 2066
as green manure, 1585
Cnaphalocrocis medinalis, 675
Cockchafer — see *Melolontha melolontha* and *M. vulgaris*
Cocksfoot — see *Dactylis glomerata*
Cocoyams (*Colocasia* spp.)
C. antiquorum
corm(s)
dry-matter and starch content, 1899
starch content, 1899
harvesting, 302
in Kenya, 302
pests, *Tarophagus proserpina*, 301
seed rate, 302
spacing, 302
C. esculenta
carbohydrate content, 815, 816
fertilizers, 817
propagation, 817
storage, 816
varieties, 815, 816
Colletotrichum hibisci, 1930
C. linicola, 1447
Colocasia spp. — see Cocoyams
Colombia
maize, races of, 1186
potatoes, 228
rice, 661*
wheat varieties, 557
Combine-harvesting — see Harvesting
Common land, England and Wales, 1636
Conium maculatum — see under Weeds
Contarinia sorghicola, 108, 1215
Convolvulus arvensis — see also under Weeds
germination, 920
Copper and plant metabolism (review), 1965
Corchorus spp. — see Jute
Corn earworm — see *Heliothis zea*
Coronopus didymus — see under Weeds
Corynebacterium sepedonicum, 245
Costa Rica
maize varieties, 633
rice, red, control of, 1235
Cotton (*Gossypium* spp.)
after elephant grass, 821
after ley, 821
after rice, 1422*
boll
number and sowing date, 1416
size and sowing date, 1416
shedding, 1441(3)
chemical composition and nutrition, 1961
climate, and fibre quality, 1435, 1436
cropping, single- v. double-, 823
cultivation, 966, 1419
autumn- v. spring-, 1908
flat- v. ridge-, 823
mechanized, 303
on saline soil, 1575
ploughing, 1534
ridging, 823, 825
defoliants, effect of,
amitrol, 1918, 1919
calcium cyanamide, 845
endothal, 1918, 1919
magnesium chlorate, 845
PCP, 1918
sodium chlorate/sodium metaborate, 1918
sodium cyanamide, 1918
sodium, ethyl xanthate, 1918
diseases
' bacteriose', 1441(3)
Fusarium sp., 327
Macrophoma phaseoli, 316
Pythium debaryanum, 311
Rhizoctonia solani, 311, 1425
seed-borne, 2057
' shimbu', 316
Verticillium dahliae, 326
Xanthomonas malvacearum, 820, 831, 1913
drought, effect of, on leaf stomata, 842
earliness
and sowing date, 1416
estimation of, 321*
evapotranspiration and yield, 991
fertilizer requirements, 529
fertilizers, 322, 323, 324, 325, 327, 494, 822, 824, 825, 832, 848, 991, 1418, 1429, 1438, 1439, 1441 (1) (3), 1442, 1904*, 1908, 1921
fibre
cell structure studies, 843*
discoloration and climate, 1436
length, 320
quality, 320, 1435, 1436
strength and climate, 1435
flowering, 1441(3)
fruiting points, no. of, and spacing, 824
fumigants, SO_2, effect of, 1920
fungicides, effect of, 1913
captan, 311
ceresan 200, 311, 837
ceresan M-2x, 311
fernasan, 829
nabam, 837
panogen, 311
rhizoctol, 1425
spergon, 829
thimet, 838
G. arboreum, 319
G. arboreum race *soudanense*, 308
G. arboreum var. *indicum*, 1416
G. barbadense, 308, 314, 832, 1429, 1441(2) (3)
G. barbadense × *G. hirsutum*, 1912
G. herbaceum, 1942
G. herbaceum var. *acerifolium*, 308
G. herbaceum × *G. anomalum*, 840
G. hirsutum, 319, 1437, 1441 (3), 1961
G. hirsutum × *G. hirsutum* var. *punctatum*, 308
G. hirsutum var. *punctatum*, 308
green manures, effect of, 1908
growth and soil moisture, 841
growth substances and seed-cotton yield, 319
growth substances, effect of, — see also defoliants above
α-naphthaleneacetic acid, 310
boric acid, 310

copper sulphate, 310
dithiobiuret, 1437
GA, 846, 1915
IAA, 319
IBA, 319
IPA, 319
magnesium sulphate, 310
manganous sulphate, 310
NAA, 319
nicotinic acid, 310
PAA, 319
potassium bromide, 310
TIBA, 319
2,4-D, 319
zinc sulphate, 310
herbicides, effect of,
dinoseb, 1562
2,4-D, 825
in Africa, 1048
in Argentina, acreage and yields, 2025
in British Guiana, 825
in Ethiopia, species, 308, 1527
in India, survey, 537
in Indonesia, survey, 305
in Peru, 1418
in USA, 303
in USSR, 1440
insecticides, effect of,
American cyanamid, 315, 1433
Bayer 19639, 315, 837, 1426, 1427, 1433
BHC, 326, 1913, 1917
dieldrin, 1913
DDT, 326, 833, 835
demeton, 315
thimet, 311, 315, 837, 1426, 1427, 1433
toxaphene, 835
intercropping, 1421, 1441(2)
interplanting, 326
irrigation, 444, 822, 841, 842, 1416, 1419, 1420, 1440, 1441(3) (4)
and insecticides, 835
-date determination, 1905*
on paddy land, 304
leaf
analysis and yield prediction, 1741
chemical composition
and defoliants, 1919
N, and pests, 832
Zn content, 1970
respiration and defoliants, 1918
stomata and drought, 842
stomata studies, infiltration technique, 895
light intensity and fibre strength, 1435
mulching, effect of, 1417
nutrition, 1741, 1961
on paddy land, 304
on reclaimed land, 437
on saline soil, 1440, 1575, 1578, 1942
pests, 836, 1048, 1431, 1441(1), 1606, 2092
Agrotis infusa, 839
Anomis flava, 839
A. texana, 1434
Antarchaea chionosticta, 839
Anthonomus grandis, 1432
ants, 316
Argyroploce sp., 1441(2)
Aphis spp., 837
A. gossypii, 313
Austroasca terrae-reginae, 839
A. viridigrisea, 839
Bemisia tabaci, 832, 1430
Diparopsis sp., 1441(2)
Dysdercus sp., 825
Earias sp., 437, 834, 1441(2)
E. insulana, 1441(3)
Empoasca spp., 1434
E. devastans, 1430
E. libyca, 832, 1429
Euxoa radians, 839
Frankliniella spp., 837, 1427
F. fusca, 315
F. occidentalis, 1433
F. tritici, 315
Gueriniella sp., 316
Heliothis sp., 1441(2)
H. armigera, 839
H. zea, 1432
Helopeltis schoutedeni, 312
Hemitarsonemus latus, 313
Hercothrips fumipennis, 832
Lygus vosseleri, 834
Meloidogyne incognita acrita, 314
Prodenia litura, 1428
Psallus seriatus, 1427
Tetranychus telarius, 313
plant height and sowing date, 1416
plant population, 1089*, 1904*, 1442, 1441(3), 1483
rainfall, effect of, 479, 832, 841, 842, 1435
ratooning, 825, 1418
rotations, 304, 314, 821, 825, 966, 1424, 1440, 1583, 1907, 1921
salt resistance, 1941
seed
chemical composition
guthion determination, 890*
molybdenum, 1914*
oil content, 320
protein content, 320
damaged, insecticidal treatment of, 1427
drying, in-sack, 2064
germination
and fat utilization, 318*
and growth substances, 310
and salinity, 1942
and temperature, 1903*
temperature and viability, 317
1000-seed wt and sowing date, 1416
v. ratoons, and yield, 1418
viability and temperature, 317
seed cotton, yield, and growth substances, 319
seed rate, 829, 1419, 1442
seed storage, 830, 2064
seed treatment, 310, 311, 315, 820, 828, 829, 831, 837, 838, 1425, 1426, 1427, 1441(1) (3), 1913, 1915, 1916
seedling
diseases, 310, 829
drought resistance and seed treatment, 1916
emergence and seed treatment, 311, 828
fat utilization, 318*
gibberellin, effect of, 1915
soil fumigation, effect of, 1606
soil moisture, effect of, 835, 841 — see also irrigation and rainfall above
sowing date, 326, 327, 820, 823, 825, 829, 833, 966, 1416, 1417, 1419, 1441(1) (3) (4), 1903*, 1908
spacing, 327, 822, 824, 1418, 1441(2) (3), 1442
stem, moisture stress and electrical resistance, 379
temperature, effect of, 1435, 1903*
topping date, 826
varieties, 482, 827*
in Argentina, 320
in Brazil, 309
in Brit. Guiana, 825
in Morocco, 1441(3)
in Pakistan, Multan, 307
specific
A 51-63....1441(2)
A 56/2....831
A 150....1441(1)
A 151....1441(2)
A 333....1441(2)
Acala....1441(4)
Albar....823
Albar 49....831
Allen 150....1441(1)
Allen 151....1441(2)
Allen 333.....1441(2)
Allen common type....1441(1)
American Upland....319
Anié 53, 54, 55....1441(2)
BAR 7/8. 1....1913
BAR XL1....327, 848
BAR XL3....327
Bhoj....319
BP52....823, 833
D-9....1441(1)
DC. 109....1423
DE 715/6....326
Deltapine 15....1911
Dendera....1441(3)
Desi....319
Giza 30....828
H.14....306
IAC-8....309
IAC-9....309
IAC-13....309
IAC. 817....309, 313
Indore-1....319
Karnak 55....1441(3)
Lasani-II....307
MCU-2....1424
Mollisoni 60-A2....1423
Mono 55....1441(2)
MSI....327
N17....1417
No. 8MB....823
No. 47/10....326
No. 58-151....1441(1)
No. 124F....307
No. 150-K....1441(1)
No. 216 F....306
Paymaster....1441(3)
Pima 67....1441(3)
Rex....1911
S47....326, 820, 823, 833
Samaru....1441(1)
Seabrook....327
Seabrook 12-B-2....327
Stoneville....1441(4)
Stoneville 7....1911
TK-1....1441(1)
type L....1429
type S....1429

Uk 48....326
Uk 51....326, 1417
Uk 55....1417
VH 8....327
VH 10....327
Wilds Early....848
testing methods, in N. Carolina, 1922
water regime, 1905*
water requirements, 844, 848
water use and evapotranspiration, 991
weeds in, 937, 1552
yield prediction, by leaf analysis, 1741
Cotton fleahopper — see *Psallus seriatus*
Couch grass — see Weeds, *Agropyron repens*
Cover crops
and soil conservation, 1554
barley, 210
in Fr. W. Africa, 203
on saline soils, 467
Cowpeas (*Vigna* spp.)
as green manure, 598
cropping, mixed, 1210
cross-inoculation group, 749
cultivation, on saline soil, 1575
diseases, *Phytophthora vignae*, 166
evapotranspiration, 991
fertilizers, 991
harvesting, 202
in Fr. overseas territories, 746
in Kenya, 202
on saline soil, 1575
rotations, 1225
seed, chem. comp., 1822
seed rate, 202
seed treatment, 167, 1297
seedling growth and seed fumigation, 167
spacing, 202
varieties, 166, 717
V. sinensis, 598, 717, 746, 1210, 1225, 1297, 1822
V. unguiculata (*catjang*), 167, 202
water use and evapotranspiration, 991
Crabs, in rice-fields, 676
Cratylia floribunda, cross-inoculation, 749
Creeping jenny — see Weeds, *Convolvulus arvensis*
Creeping saltbush — see *Atriplex semibaccatum*
Cricotopus trifasciatus, 1238
Crop(s) — see also Plant(s) and indiv. crops
Ca distribution in, 881*
diseases, 522
biological control, 523
green, dry-matter determination, sampling technique, 893
nutrient deficiencies, 876, 2069*
K-def. diagnosis, 529
nutrient uptake, K, 1963
sampling unit, optimum size, 498
tolerance to soil acidity, 881
varietal trials, between-trials error, 1802
varieties
classification, Weighted-Rankit method, 496
nomenclature, 1998
water requirements, 876
yield and photosynthetic potential, 870, 871
Crop production, 505*, 2079
Cross-inoculation — see under Legumes
Crotalaria spp.
evapotranspiration and yield, 991
fertilizers, 991
C. astragalina, root excretions, 748
C. juncea — see Sunnhemp
C. quinquefolia, as green manure, 695
C. retusa, root excretions, 748
C. spectabilis, root excretions, 748
Cuba
land use, 2029*
rice, 1760*
Cucumis melo — see Melon
C. sativus, frost resistance, 359
Cultivation, 2086 — see also Cereals and indiv. crops
and weed control, Ceylon, 1554
ploughing
and weed control, 1534, 2009
depth, 440, 483, 961
meadowland and subsequent crop yield, 1581
rotary
and weed seed survival, 2009
review, 439
surface, 483
Cutworms — see *Euxoa radians* and *Agrotis infusa*
Cyamopsis spp. — see Guar
Cynodon sp., 977
C. dactylon, 461 — see also under Weeds
C. plectostachyus, 451, 975
Cyperus sp. — see under Weeds
Cyprus
potatoes, 227*
safflower, 864
Czechoslovakia, agricultural production, 1640*
Dactylis glomerata, 603, 1115, 1280
Darso — see Sorghum, *S. vulgare* var.
Dasheen — see Cocoyams
Datura spp., xanthozillin, effect of, 1956
Daucus spp., gibberellin, effect of, 874
D. carota, 2008
Defoliants
amitrol, 1918, 1919
arsenic trioxide, 779
arsenol, 787
calcium cyanamide, 845
dinosam, 779
dinoseb, 779
endothal, 779, 1918, 1919
MCA, 2013
klorex, 787
magnesium chlorate, 845
PCP, 779, 1918
sodium chlorate/sodium metaborate, 1918
sodium cyanamide, 1918
sodium ethyl xanthate, 1918
Denmark, Mo deficiency, 495
Desiccant, 1 : 1¹-ethylene-2 : 2¹-dipyridylium dibromide, 1558
Desmodium spp., cross-inoculation, 749
Dichrostachys sp. — see under Weeds
Digitaria spp. — see under Weeds
Dioscorea spp. — see Yams
Diparopsis sp., 1441(2)
Diplotaxis tenuifolia — see under Weeds
Diptera, 1607*
Ditylenchus dipsaci, 592, 1139, 1148, 1690
Dock — see Weeds, *Rumex* sp.
Dolichos lablab — see *Lablab niger*
D. uniforus, 1631
Drought resistance — see Plant(s), environment and indiv. crops
Durra — see Sorghum, *S. vulgare*
Dwarf bunt — see *Tilletia controversa*
Dyscinetus sp., 1381
Dysdercus sp., 825
Earias spp., 437, 834, 1441(2) (3)
Earthworms, 1018, 2066
Echinochloa crus-galli — see under Millets and Weeds
Ecology, in Africa, 1634
Ecuador, micrometeorology in, 2054*
Eddo — see Cocoyams, *Colocasia antiquorum*
Eelworm — see *Anguillulina tritici*, *Ditylenchus dipsaci* and *Heterodera major*
Egypt, land use in, 431
Egyptian clover — see Clover, *Trifolium alexandrinum*
Ehrharta calycina, 467
E. villosa, 982
Eichhornia crassipes — see under Weeds
El Salvador, maize varieties in, 633
Eleocharis plantaginea — see under Weeds
Elephant grass — see *Pennisetum purpureum*
Eleusine coracana — see under Millets
Empoasca spp., 1429, 1430, 1434
Epicauta atomaria, 1381
Equisetum arvense — see under Weeds
Eragrostis abyssinica, 457
E. tef, 1220
Erwinia spp., 245, 1400
Erysiphe graminis, 62, 1106, 1690, 1702
Ethiopia
cotton spp., 308
highlands, crops grown in, 657
sorghum, 657
Spermaphyta, list of spp., 1527
Euonymus europaeus, 215
Euphorbia spp. — see under Weeds
bud dormancy, 932, 933
Eurygaster spp., 710
Euxoa radians, 839
Evaporation, 1479
and soil temperature, 1587
and windbreaks, 2055
from covered and uncovered plots, 1736
from open water surfaces, 984
from saturated sand, 984
Evapotranspiration, 991, 992, 1093, 1600, 2048, R.A. p.1 — see also indiv. crops
and windbreaks, 2055
measurement, 473, 988, 989, 990, 991, 992, 1517, 1518, 1600, 1735, R.A. p. 4
Eyespot — see *Cercosporella herpotrichoides*
Fagopyrum esculentum — see Buckwheat
F. sagittatum, for fodder, 2042
F. tataricum — see also under Weeds
for fodder, in Germany, 2042
dormancy, 922
germination and growth, 923
growth substances, xanthozillin, effect of, 1956
root-hair growth and xanthozillin, 1956
Fallowing — see under Farming systems
Farm management, 1062*
analysis, 1616*
economy, Gt Britain, 504*

handbk, 1008*, 2089
linear programming, 1014*
records and accounts, 455*
vertical-block budgeting system, 1618*
work study, 1063*
Farm produce, Gt Britain, survey, 1000*
Farming, advisory work, 1617*
Farming systems, 520 — see also Rotations, Shifting cultivation and Soil and water conservation
burning, 1580, 2044
chemical ploughing, 980
cropping
arable, duration of, and crop yields, 2040
catch-, 2041
double-, 1225, 2041
in Sweden, Västmanland Prov.,
fallowing, 1580
and water conservation, 1593
in Ghana, 963
in N. Nigeria, 1579
in Africa, 2082, 2086
N. Rhodesia, 962, 2022*
Tanganyika, 453*
Uganda, Namulonge, 1907
in Australia, W., 540*
in Brazil, Rio Grande do Sul, 2030*
in Gt Britain
dairy farming, Kent, 964
Romney Marsh, 965*
in Indonesia, 959*
in USA, 454*
in USSR, S. Ukraine, 2036*
in W. Samoa, 2023*
linear programming, 1014*
mixed farming, in tropics, 1588
ridging, tied-, 1907
shifting cultivation, 2086
strip farming on contour, 1907
Fat hen — see Weeds, *Chenopodium album*
Fenugreek (*Trigonella foenum-graecum*), 657, 1631
Fertilizers, 505*, 1061* — see also Micronutrients and under Cereals, Legumes and individual crops
and deep ploughing, 440
in Gt Britain, 1005, 1006
in India, W. Bengal, 425
nomenclature, 1056
placement, 2069*
specific
copper, 1965
f.y.m. (bibl.), 491
lime, 880, 1007, 1613
magnesium, 1635
potash, 529, 1963
sulphur, 883, 884*
studies and radioisotopes, 528
Fescue — see *Festuca* spp.
Festuca arundinacea, 467, 1115
F. elatior var. *arundinacea*, 1798
F. pratensis, 1582, 1924
F. rubra, 1115, 1924
Fibre flax (*Linum usitatissimum*), R.A. p. 259
chem. comp., Mn localization, 1968
cultivation, 1443, 1923
diseases, 1016, 1923, R.A. p. 262
Alternaria linicola, 1447
Ascochyta linicola, 850
Botrytis cinerea, 850, 1447
Colletotrichum linicola, 1447
Melampsora lini, 1445
Phoma sp., 1447
Polyspora lini, 1447
seed-borne, 1447, 2057
drying, 851
fertilizers, 333, 1923, R.A. p. 260
fibre, quality and harvesting date, 329
green manures, effect of, 449
growth substances, xanthozillin, effect of, 1956
harvesting, 328*, 849, 1443, 1923
harvesting date, 329, R.A. p. 262
herbicides, effect of, R.A. p. 261
CIPC, 949, 1448
dinoseb, 1925
DNC, 1925
MCPA, 949, 1925
MCPB, 949, 1925
4-(MCPB), 2014
2-(MCPP), 2014
propham, 949
2,4-D, 332
2-(2,4,5-TP), 2014
in Australia, W., 1443, 1444
in Netherlands, 1923
in N. Ireland, 328*
insecticides, effect of,
disyston, 1928
heptachlor, 1928
lindane, 1928
thimet, 1928
light intensity and 2,4-D action, 332
nutrition, 1496
on reclaimed land, 437
pests, 1923, R.A. p. 262
Aphthona euphorbiae, 331
Longitarsus parvulus, 331
Thrips angusticeps, 1928, 1929
Th. lini, 1928
retting, 851, 852
water purification for, 853
root-hair growth and xanthozillin, 1956
rotations, 449, 1923, R.A. p. 260
seed, Mn localization in, 1968
seed rate, 1923
seed storage, 1927
seed treatment, 850, 1447, 1923, 1927, 1928, R.A. p. 261
sowing date, 1923, R.A. p. 261
sowing method, 1923, R.A. p. 261
temperature and 2,4-D action, 332
undersowing, 1923, 1924
varieties, 1923, 1445
in Hungary, 330
weeds in, 1550, 1923, 1924, 1925, 1926, 2014, R.A. p. 261
Avena fatua, 2000
Camelina sp., 1446
Setaria viridis, 1540
Field experimental method
factorial-trial analysis, sugar-beet, 497*
fertilizer expts
analysis of data, 1744
plot edge effects, 493
harvesting technique, 1011
plants grown in mixture, 1525
plot size, 1013
peas, for canning, 656
soyabean yield trials, 1807*
sweet-corn, 656
recording systems, 499
row spacing, 1525
varietal trials
analysis of data, 1012, 1013
cereals, 1291
error, between-trials, 1802
Finger millet — see Millets, *Eleusine coracana*
Flax — see Fibre flax and Oil-seed flax
Flea beetle — see *Phyllotreta* spp.
Flora
of Africa, maps, 1075, 1567
of Belgian Congo and Ruanda-Urundi, 526*, 1053
of Gt Britain, 1052
of W. Africa, 525
Pteridophyta, Chinese/English names, 1054
Spermatophyta, Chinese/English names, 1054
Fodder-beet (*Beta vulgaris*)
cells, parenchymatous, structure of, 352
cultivation and soil moisture, 365
diseases
Botrytis sp., 223
Cercospora beticola, 763
Fusarium sp., 223
Helicobasidium purpureum, 224
drought resistance, 365
dry-matter yield and harvesting date, 1358
fertilizers, 365, 765, 766, 1613
for silage, in Bavaria, 1204
growth substances, conserbeta, effect of, 223, 224
harvesting technique, in field expts, 1011
harvesting date, 1358
herbicides, effect of, 949
dalapon, 949
PCP, 222
simazin, 1730
insecticides and crop quality, 1610
irrigation, 1586
leaf
Na content, 766
yellowing, 766
pests, aphid, 223
root development and soil aeration, 365
rotations, 1582
seed
germination testing, 1348
viability, duration of, 351
seed production, Sweden, 1074
seedling
emergence, factors affecting, 766
identification, 1346
soil moisture, effect of, 766
soil pH, effect of, 766
storage, 215, 223, 224
thinning, 762
varieties, 221
in Switzerland, 763
specific
Altenburger....351
Barres....1358
Barres Kostelecka....763
Barres Øtofte Nova X....221
Barres Øtofte X....221

Barres Strynø X....221
Corona....763
Hinderupgaard X....221
Hollandia....763
Hunsballe X....221
Oetofte Gelbe....763
Pajbjerg....763
Pajbjerg Rex X....221
Red Øtofte....765
Solid....762
Teutonica....351
Udyckie Polenkrowe....763
Zentaur....763
water balance, factors affecting, 365
weeds in, 222, 764
Fodder crops (general) — see also individual crops
storage, 819
symposium, Polish Acad. Sci., Inst. Pl. Breed., 1074
Foliar diagnosis — see Plant(s), leaf, diagnosis
Foliar nutrition — see leaf nutrition under Plant(s) and indiv. crops
Formosa (Taiwan)
agric. mechanization, 443*
agric. production, 1574*
sweet-potatoes, varieties, 291
Foxtail millet — see Millet, *Setaria italica*
France
climate/soil complex, 2065
land reclamation, drained marshland, 435
land use, 433*
maize, 1726
potatoes, 1891
rice
in Camargue, 696, 1229
weeds in, 670
wheat, 1646
Frankliniella spp., 87, 315, 837, 1427, 1433
French millet — see Millets, *Panicum miliaceum*
French Oceania
climate, 952
land reclamation, 1576
land use, 952
rice, 1576
French W. Africa
cover crops, 203
green manures, 203
rice, 1758, 1759
Frit fly — see *Oscinella frit*
Frost damage — see under Weather
Frost resistance — see under Plant(s), environment, and indiv. crops
Fumigants, 165, 1606
aluminium phosphide, 652
bromofume 85, 314
carbon disulphide, 108, 256
carbon tetrachloride, 653
chloropicrin, 1665
DD, 314
ethylene dichloride, 653
hydrocyanic acid, 1132
hydrogen phosphide, 1131
methyl bromide, 647, 651, 1132, 1202, 1288
nematox, 145, 314
rhizotox, 1855
sulphur dioxide, 1920
vapam, 924
Fungicides, 591, 1049, 1050, 1855, 1913
and plant chem. comp., 523
residues, 1611
specific
aardisan, 1376
agrosan, 1732
agrosan GN, 1297
albertan, 155
arasan, 562, 1187, 1733
aretan, 1376
arsenic, 15
betoxin, T.D., 40
bioquin 1, 1310
Bordeaux mixture, 213, 254
caffaro, 1829
captan, 311, 1733
cerenox special, 1310
ceresan, 311, 837, 1109, 1732
copper carbonate, 1732
copper oxychloride, 1829
copper oxychloride sulphate (COCS), 254, 1375
copper sulphate, 254
coversan, 1732
cuprous oxide, 1311
dihydrostreptomycin, 1375
dithane M.22, 777
DL-ethionine, 1375
dynamal, 155
ethyl mercuric chloride, 1853
ethyl mercury phosphate (EMP), 1830
fernasan, 828, 829, 1297, 1732
flit 406, 1297
germisan, 600
granopera, 1441(1) (3)
hexachlorbenzene, 1110
lindane, 1829
manzate, 777
mergamma, 1829
nabam, 254, 837
1-chloro-2-butanone, 1203
1(2,3)-chloro-4-methyl-2-pentanone, 1203
orthocide 50, 777
panogen, 40, 311, 1441(3)
PCNB, 252, 253, 1110
perenox, 1377
phenyl mercuric acetate, 1853
rhizoctol, 1425
NaOCl, 1109
semesan-bel, 1862
spergon, 829, 1297, 1310
streptomycin, 1375
sulphur, 1311
terrachlor, 1378
tetramethyl thiurame disulphide, 1927
tetroc, 1732
thimet, 838
thiram, 850, 1310, 1447
TMTD, 40, 600
2,3-dibromopropionic acid, 1203
2,4,6-trichlorophenol, 1203
3,5-dimethyltetrahydro-1,3,5, 2H-thiadiazine-2-thione, 1203
UF-85, 252
zinc, 254
zineb, 253
Fungus diseases, 523, 889*, 1015, 1494 — see also indiv. diseases and under indiv. crops
Fusarium spp., 223, 327, 711, 1776
F. moniliforme, 1201
Galinsoga parviflora — see under Weeds
Gamba — see *Andropogon gayanus*
Gambia
land-use survey, 1078
rice, acreage, 1078
Geoffraea decorticans — see under Weeds
Geotropism — see under Plant(s) and indiv. crops
German millet — see Millets, *Setaria italica*
Germany
Eastern
catch crops, 2041
hail damage, 471
Western
fodder-beet, for silage, in Bavaria, 1204
land use, in Lower Bavaria, 1572*
maize, for silage, in Bavaria, 1204
potatoes, varieties, 1850
Ghana, soils and vegetation, 963
Gibberella zeae, 62
Gilbert Is.
agriculture, 427
climate, 427, 481
Glaucium corniculatum — see under Weeds
Gliricidia sp., as green manure, 978
Glyceria spp., 1946
Glycine gracilis, for forage, Japan, 1328
G. hispida — see Soyabeans (*G. max*)
G. max — see Soyabeans
G. soya — see Soyabeans (*G. max*)
Gnorimoschema operculella, 256, 1381
Golden thistle — see Weeds, *Scolymus hispanicus*
Gossypium spp. — see Cotton
Gourd (*Lagenaria vulgaris*), interplanting, 657
Gram — see Chickpeas
Great Britain
agricultural economics, 504*, 1002*
agricultural statistics, 999*
agriculture, 430*, 1055*
in Anglesey, 950
in Yorkshire, small farms, 2018*
climate, maps, 1060*
common land, report on, 954
crops
barley, 1047
varieties, 1151
beans, 193
cereals, varietal trials 1955–7, 1291
oats, 1047
in Scotland, 1137
costs, 48, 599, 1147
peas, 184
potatoes, costs, in Scotland, 1406
rye, 1047
sugar-beet
production, labour requirements, 1355
yields in 1958, 1066
swede-turnips, types, 767
turnips, costs, in N. Scotland, 599
wheat, 545, 1047
varieties, 1096, 1097
farm produce, survey, 1000*
farming
dairy-, in Kent, 964
profits, S.E. England, 1001

systems, 520
on Romney Marsh, 965*
fertilizers, 1005, 1006
flora, illus., 1052
herbicides, 2011
land use, 430*, 953*, 1055*, 2027*
soil survey, Anglesey, 950
water conservation and use, 460
weather, 1060*
rainfall averages, 1916–50, 1604*
Greece, rotations and soil N, 2043
Green bristle grass — see *Setaria viridis*
Green manures, 449, 1839, 1909*
in Fr. W. Africa, 203
in India, 978
N production by, 621
specific
beans, *Phaseolus mungo*, 598
clover, 277, 1585
cowpeas, 598
Crotalaria quinquefolia, 695
Gliricidia sp., 978
grass, 277
guar (*Cyamopsis psoraloides*), 1921
Indigofera teysmanni, 978
Ipomoea carnea, 978
Lespedeza sp., 465
lucerne, 621, 642
lupins, 450
mustard, 277, 450
peas, 1647
Pongamia glabra, 978
rape, 277
rye, 277, 1647
Sesbania aegyptiaca, 978
S. speciosa, 978
shabdar (*Trifolium resupinatum*), 1908, 1910*
sunnhemp, 1583
sweet-clover, 34, 621, 1647
velvet beans, 1583
vetch, 450, 598
Greenland, climate, 476*
Groundnuts (*Arachis hypogaea*), 1631
A. hypogaea × *A. monticola*, 175
cultivation, 1305
for rainfall conservation, 1595
on saline soil, 1575
ploughing depth, 966
ridged v. flat, 173
diseases
Cercospora sp., 1311
seed-borne, 2057
drying, 1308, 1812, 2064
fertilizers, 181, 483, 494, 529, 976, 1007, 1305, 1306, 1318
flower removal, effect of, 1314
flowering, 730, 1314, 1316, 1810, 1811*
fruiting, 730, 1811* — see also seed below
growth, 731
growth substance, MH, effect of, 731
harvesting, 350, 1308
combine-, 1812
harvesting date, 174, 723
herbicides, effect of,
dinoseb, 1562
Dow premerge, 1309
in Australia, N., 724
in Ethiopia, highlands, 657
in Kenya, 350
in S. Africa, 1305
inoculation, 1331
interplanting, 657, 1584
irrigation, 174, 1808
leaf stomata, 1313
oil yield and growing period, 174 — see also under seed below
on saline soil, 1575
pests
Pachymerus acaciae, 1312
Tribolium castaneum, 183
photoperiodism, 1315
plant population, 731
pollen-grain germination, 178
rainfall, effect of, 1306, 1307, 1595
rotations, 966, 967, 968, 1580, 1583, 1808, 1907
and water conservation, 457
seed
chemical composition, 727*
oil content, 729
development, 728, 1315
dormancy, 179
germination, 729
polyembryony, 177*
water content, 729
seed rate, 350, 723
for soil and water conservation, 2046
seed treatment, 1297, 1306, 1310
soil moisture, effect of, 1317
sowing date, 174, 483, 1305, 1307, 1595
spacing, 173, 350, 483, 723, 731, 1305, 1309, 1318
storage, 183, 2064
temperature, effect of, 724, 1307, 1316
transpiration, 1313
varietal classification, 180
varieties, 174, 482, 725, 729
in India, Bihar, 1809
intervarietal competition, 731
specific
Bandeirante-263....726
Big Japan....1809
Brasilia-265....726
Centenário-264....726
Matevere group....180
Paulista-269....726
Spantex....178
Tatuí-76....726
TMV.1....1809
Valencia group, 180
Virginia Bunch 67....179
Virginia-266....726
weeds in, 937, 1309
Caladium bicolor, 1309
Cyperus rotundus, 1309
Growth substances, 522, 2068*, 2083
specific
α-naphthalene acetic acid (planofix), 299, 310, 847
AMO-1618, 2091
ATA, 266, 1384
boric acid, 310
catechol, 1862
CIPC, 266, 1384, 1859
conserbeta, 223, 224
copper sulphate, 310
dalapon, 1860
DCA, 1850
dithiobiuret, 1437
DNC, 1384
gibberellin, 190, 267, 268, 339, 366, 367, 368, 369, 370, 371, 568, 585, 793, 846, 873*, 874, 875, 912, 913, 933, 1162, 1352, 1386, 1452, 1485, 1486, 1487, 1488, 1734, 1834, 1856*, 1857, 1858, 1859, 1915, 1932, 1950, 1951, 1952, 1953, 1954
IAA, 21*, 130, 369, 370, 872, 1860
indolyl butyric acid, 299
IPC, 1880
kinetin, 367, 1386, 1954
magnesium sulphate, 310
manganous sulphate, 310
MCPP, 1384
MENA, 281, 1384
methylethylnaphthyl ester (METER), 1384
MH, 21*, 266, 267, 270, 286, 731, 872, 1384, 1873
MH-30, 1872
NAA, 130, 913, 1401, 1859, 1860
nicotinic acid, 310
O-methyl threonine, 266
phenylurethane (PU), 1384
planofix — see α-naphthalene acetic acid
potassium bromide, 310
propham, 1384
rindite, 607
sulphanilamide, 1242
TCNB, 281, 1384
TIBA, 369, 1860
2,3,5-triiodobenzoic acid, 1490
2,3,6-TBA, 1490
2,4-D, 270, 913, 1490, 1556
2,4,5-T, 1304*, 1384
2,4,5-TP, 1384
2,6-dichlorobenzoic acid, 1490
TIBA, 1491
urethane, 282
zinc, sulphate, 310
Guar (*Cyamopsis tetragonoloba* [*psoraloides*]), 1631
as green manure, 1921
cropping, mixed, and protein yield, 1751
seed germination and soil salinity, 1942
Guatemala, maize varieties, 633
Gueriniella sp., 316
Guinea corn — see Sorghum, *S. vulgare*
Guizotia abyssinica — see Niger seed
Hail damage — see under Weather
Harvesting — see also indiv. crops
combine-, 961
technique, in field expts, 1011
Helianthus sp. — see under Weeds
H. annuus — see Sunflower
H. ciliaris — see under Weeds
H. tuberosus — see Jerusalem artichoke
Helicobasidium purpureum, 224
Heliothis sp., 1441(2)
H. armigera, 76, 839
H. zea, 1206, 1432
Helminthosporium gramineum, 1152
H. oryzae, 126
Helopeltis schoutedeni, 312
Hemitarsonemus latus, 313
Hemp (*Cannabis sativa*), 2078
breeding, 2078
diseases, 2078
fertilizers, 2078
irrigation, 854
pests, 2078

rotations, 2078
seed production, 2078
water requirement, 854
weeds in, *Orobanche ramosa*, 410
Herbicides, 412, 420, 532, 937, 946, 1051, 1551, 1553, 2011, 2069*, 2081, 2083
and plant chem. comp., 523
application method and effectiveness, 2012
chemical ploughing, 980
cultivations reduced by, 786
in Gt Britain, 2011
nomenclature, 2011
phytotoxicity studies, 419*
residues, 1611
soil incorporation of, 2012
specific
alanap, 171, 247
allyl alcohol, 735
amitrol (ATA, amizol, amino triazole), 101, 671, 917*, 936, 1195, 1532, 1539, 1540, 2004
arsenite, 788
ATA — see amitrol
BNP 20 — see dinoseb
calcium cyanamide, 188
CDAA, 171, 192, 246, 249, 631, 910, 927, 948, 1292, 1540, 1561
CDEA, 247
CDEC, 171, 192, 246, 247, 249
CDT, 246
CIPC, 171, 764, 927, 949, 1448, 1540, 1559*, 1771
CMU — see monuron
copper sulphate, 1926
CP 18-15, 2015
crotilin, 2016
dalapon, 102, 246, 247, 248, 249, 398, 399, 414, 416, 671, 758, 907, 924, 931, 949, 1321, 1531, 1533, 1539, 1540
DCU, 758, 1540, 1560
diesel oil, 1539
dinoseb, 85, 171, 188, 246, 248, 249, 396, 420, 655, 732, 734, 785, 788, 1320, 1321, 1562, 1925, 1926
diuron, 84, 85, 247, 249, 786, 1560
DNC (DNOC, hedolit), 420, 788, 1185, 1285, 1924, 1925, 1926, 2013
dowpon — see dalapon above
Dow premerge, 1309
emid, 85, 171, 786
EPTC, 171, 246, 249, 395, 948
erbon, 919, 931
fenuron, 919, 1560
fernoxone, 1541
4-chloro-2-butynyl-N-3 chlorophenyl carbamate, 1540
4-(MCPB), 2014
G27901, 84
G-30028, 85
GA, 1488
Geigy brush killer No. 22, 409
hedolit — see DNC
IPC — see propham
karmex, 85
kuron, 406
MCA, 2013
MCPA, 67, 250, 397, 401, 403, 420, 559, 707, 785, 914, 927, 934, 949, 1320, 1321, 1454, 1489, 1925, 1926, 2013, 2015
MCPB, 403, 734, 927, 949, 1236, 1321, 1925
MCPP, 949
MH, 250, 397, 926, 1531
monoxone, 764
monuron (CMU), 85, 246, 249, 415, 785, 786, 1342, 1560
natrin, 247
neburon, 85, 171, 246, 249, 786, 921, 1540
NPA, 249
oils, 721, 1539
1 : 1^1-ethylene-2 : 2^1-dipyridylium dibromide, 1558
PBA-1, 927
PCP, 171, 222, 788, 1342
polychlorobenzoic acid, 919
propham (IPC), 192, 211, 910, 927, 949, 1540
sesone, 786
sevtox — see dinoseb above
simazin, 84, 85, 171, 246, 249, 415, 416, 927, 1185, 1730, 2009
sodium chlorate, 397
sodium nitrate, 212, 764
sodium tetraborate, 919
TBA, 2005, 2015
TCA, 192, 394, 397, 764, 924, 949, 1454, 1529, 1531, 1533, 1540
TCB, 416
3Y9, 247, 786
triazine, 927
2-(MCPP), 2014
2,3-dichloro isobutyrate, 249
2,3,5,6-TBA, 1540
2,3,6-TBA, 907, 1540, 2005, 2015
2,4-D, 67, 171, 246, 250, 332, 346, 397, 400, 401, 402, 403, 404, 405, 408, 409, 411, 420, 560, 655, 671, 707, 825, 914, 915, 916, 917*, 919, 921, 923, 926, 927, 934, 936, 939, 1163, 1185, 1234, 1236, 1320, 1489, 1532, 1537, 1544, 1545, 1555, 1556, 1557, 1731, 2015, 2016
2,4-DB, 171, 403, 924, 927
2,4,5-T, 250, 397, 407, 408, 409, 411, 420, 671, 927, 939, 1532, 1536, 1544, 1545, 2003
2,4,5-TP, 125, 949
2-(2,4,5,-TP), 919, 2014
vapam, 924, 925
weedone brackontrol, 2090
spray drift, 346, 1448
sprayers, 1563
logarithmic, 417, 418*
spraying aerial, 1234
translocation studies, 947
Hessian fly — see *Phytophaga destructor*
Heterodera spp., 245, 1280
Heteroligus sp., 1412
Heteropogon contortus, 2046
Hibiscus spp.
fibre quality, 1450, 1451
harvesting date, 1451
in Ethiopia, list of spp., 1527
sowing date, 1451
varieties, 1451
H. cannabinus — see Kenaf
H. sabdariffa — see Roselle
Hoffmanseggia densiflora — see under Weeds
Holcus lanatus, 1975
Homeria spp. — see under Weeds
Homeria spp. — see under Weeds
Honduras, maize varieties, 633
Hordeum spp. — see Barley
Horse beans — see Beans, *Vicia faba*
Hubam clover — see Sweet clover, *Melilotus alba* var. *annua*
Hungary
fibre flax, varieties, 330
maize, 516
Imperata spp. — see under Weeds
India
agriculture, 1057, 1568*
in W. Bengal, 425
climate, 1057, 1591
crops
barley, 1080
chickpeas, 1080
cotton, survey, 537
groundnuts, varieties, in Bihar, 1809
jute, 334
lentils, in U.P., 199
oil crops, in Andhra Pradesh, 1937*
oil-seed flax varieties, 340, 1934
potatoes
in N. Nepal, 1641
in W. Bengal, 515
rice
in Punjab, 668
in S. Kanara, 110
varieties, in U.P., 109, 121
sorghum, *S. vulgare*, 1080
sweet-potatoes, in Bombay State, 288
wheat, 555, 1080
varieties, in Punjab, 11
fertilizers, in W. Bengal, 425
green manures, 978
irrigation, in W. Bengal, 425
land reclamation, Punjab, 1577
land tenure, Kerala State, 1591
land use
in Damodar Valley, 1568*
in W. Bengal, 425
plant protection, Madras State, 2063*
soil and water conservation
in Damodar valley, 1597
in Kerala State, 1591
in Madras State, 1594
Indigofera spp., nomenclature, 1281
cross inoculation, 749
I. teysmanni, as green manure, 978
Indonesia
cotton, survey, 305
farming systems, 959*
rice, 699
Inoculation — see under Legumes and indiv. crops
Insecticides, 165, 489*, 1048, 1049, 1050, 1609*
and crop quality, 1610
and plant chem. comp., 523
biological, 1643
handbook, 533
residues, 1611
specific
actidrine phosphemol, 1441(2)
agrocide, 1412

aldrin, 255, 316, 487, 561, 1017, 1343, 1379, 1380, 1661, 1830, 2060
aluminium phosphide, 652
American cyanamid, 315, 1433
barium fluosilicate, 1428
Bayer 19639, 315, 562, 837, 1113, 1426, 1427, 1433
BHC, 108, 196, 301, 326, 348, 487, 561, 647, 650, 651, 675, 836, 1017, 1379, 1412, 1430, 1431, 1664, 1917
γ-BHC, 1462, 1830, 1913
BHC/Hg, 1794
bromofume, 85, 314
carbon disulphide, 256
chlordane, 316, 561
chlorinated camphene, 18
cryolithe, 1428, 1441(3)
DD, 214, 314
D-D (1,2-dichloropropane), 1895
DDT, 127, 256, 312, 326, 487, 488, 561, 632, 647, 650, 651, 712, 833, 835, 836, 839, 1140, 1141, 1187, 1206, 1207, 1412, 1429, 1430, 1431, 1432, 1462, 1832
deenate 50, 632
demeton, 215, 315
demeton methyl, 1816
diazinon 200, 1928
dieldrin, 196, 316, 769, 1017, 1084, 1111, 1141, 1462, 1661, 1830, 1913, 1928
dipterex, 674, 1207, 1432, 1831
disyston, 1832, 1928
EDB (1,2-dibromoethane), 1895
ekatin, 674, 1832
endrin, 313, 675, 836, 839, 1207, 1430, 1432, 1434, 1441 (1,2,3,), 1831
EPN, 1432
folidol E 605, 127, 858
gusathion, 674
guthion, 1432
HCH, 1428
HCN, 1132
heptachlor, 1111, 1207, 1432, 1661, 1928
hexamar, 127
hydrogen phosphide, 1131
lead arseniate, 1434
lindane, 331, 600, 650, 769, 1201, 1312, 1343, 2060, 2061, 1928
lindane 300, 1928
malathion, 348, 651, 1201
megatox, 1832
mergamma D, 1794
metaisosystox, 679
metasystox, 18, 313, 679, 1345, 1832
methoxychlor, 651
methyl bromide, 647, 651, 1132, 1202, 1288
methyl parathion, 1432
nemagon, 214, 314
nematox 45, 314
nicotine sulphate, 348
No. 43.10a-Bayer, 1343
parathion, 18, 348, 674, 675, 1141, 1345, 1462, 1831, 1929, 2059
parathion 300, 1928
PCNB, 1396
phosdrin, 1832
phosphamidon, 2061
piperonyl butoxide, 1201
pyrethrins, 1201
rogor, 1832
rotenone, 1434
sevin, 1206, 1432, 2092
sodium fluoride, 1831
sodium fluosilicate, 1428
sulphur, 1434
systox, 1345
telone, 214
thimet, 192, 311, 315, 562, 837, 1113, 1382, 1426, 1427, 1433, 1832, 1928
thiodan, 1206, 1432, 2062
thuricide, 1643
toxaphene, 312, 835, 1207, 1428, 1432
toxicity to bees, 1608
Ipomoea batatas — see Sweet-potatoes
I. carnea, as green manure, 978
Iran
land use, 431
rice, in Baluchistan, 1227*
Iraq, land use, 431
Ireland, Northern
fibre-flax-growing, 328*
rainfall averages, 1916–50*, 1604*
Ironweed — see Weeds, *Vernonia baldwini*
Irradiation, 362*, 528, 901
effect of
on barley, 1521
on Jerusalem artichoke, 1524, 1901
on leaf, 484
on potatoes, 275, 1405, 1878, 1889*
on rice seed, 699
on rye seedlings, 1992
on soyabeans, 1806
on weed seed germination, 2017
on wheat, 1467, 1519*, 1520
solar — see also Plant(s), environment, light and net assim. rate, 1477
and photosynthesis, 870
and *Ustilago* sp. control, 1711*
and water loss, 1736
Irrigation, 521*, 876, 877, 879, 2086 — see also individual crops
-channels, weed control in, 941
-date determination, 1906*
-gauge, 1517
in Argentina, 2024
in Belgian Congo, 972
in India, W. Bengal, 425
in Italy, 2032, 2033
in Japan, 2035*
in Spain, 2019
in USA, Colorado and Florida, 971
in USSR, 444
Kulunda, 2037*
S. Ukraine, 2036*
requirement estimation, 474
soil levelling for, in Peru, 970*
sprinkler, 445, 972, 1587, 2034*
sub-, 971, 2031*
-water, saline, 956
water requirements for, 973
Italian millet — see Millets, *Setaria italica*
Italian ryegrass — see Ryegrass, *Lolium multiflorum*
Italy
agricultural mechanization, 961
agriculture, Pavia Prov., 421
crops
maize, 1748
varieties, 1178, 1179, 1748
poppy, 1935
potatoes, varieties, 783, 1365
rice
-growing, mechanization in, 697
varieties, 119, 667
yields, 1228
soyabeans, 169
sugar-beet, 1337, 1338*, 1336*
varieties, 1340
wheat
acreage, 1071
varieties, 1101
irrigation, 2032, 2033
Jack beans (*Canavalia gladiata*), 1631
harvesting, 202
in Kenya, 202
root excretions, 748
seed rate, 202
spacing, 202
Japan
farming, profitability of, 456*
Glycine gracilis, 1328
irrigation, 2035*
soil conservation, cropping, 465
wheat, 3
Japanese millet — see Millets, *Echinochloa crus-galli* var. *frumentacea*
Jassids — see *Austrosca terrae-reginae*, *A. viridigrisea* and *Empoasca* spp.
Jerusalem artichoke (*Helianthus tuberosus*)
cultivation, 1900
cutting, 1900
for silage, 1413
in E. Germany, 1900
rainfall, effect of, 1900
rotations, 1900
storage, 1413
tuber
chemical composition
and irradiation, 1524, 1901
starch content and rainfall, 1900
irradiation, effect of, 1524, 1901
Johnson grass — see Weeds, *Sorghum halepense*
Jordan, land use, 431
Jowar — see Sorghum, *S. vulgare*
Jute (*Corchorus* sp.)
C. capsularis, 335, 336, 856, 858, 859a,d,f,g
C. olitorius, 335, 856, 858, 859d,f,g
cropping, triple-, 334
fertilizers, 494, 859e,f, 1449
fibre
morphology, varietal differences, 859a
yield and plant size, 859c
flowering and photoperiod, 859b
harvesting date, 859g
in China, 335
in India, 334
in Malaya, 336
interplanting, 335
leaf, nutrition, 859d
pests
Anomis sabulifera, 858
Apion corchori, 858

photoperiodism, 859b
retting, 337
/roselle, comp. yields, 856
rotations, 334
seed production, 859f,g
sowing date, 859g
submergence, resistance to, 335
varieties
in N. China, 335
specific
BZ/1-5....857
D154....859a
E.C.R. 576....857
JRC-1....859a
JRC-212....859a
JRC-321....859a
JRC-919....859a
Segama....336
Kaffir corn — see Sorghum, *S. vulgare*
Kale (*Brassica oleracea*)
B. oleracea var. *acephala*, 818, 1414, 1637, 1727
chemical composition, 1414, 1902
cultivation and use, 1010*
dry-matter
content and plant size, 1414
determination, sampling technique, 893
fertilizers, 1414, 1415
placement v. broadcasting, 492
for forage, v. maize, 1727
green manures, effect of, 450
herbicides, monoxone, effect of, 764
in S.E. Norway, 1414
leaf/stem ratio, 1902
pests, *Phyllotreta* spp., 771
plant population, 818
plant size and dry-matter content, 1414
root, cation-exchange capacity, 1959
seed rate, 1414
seed treatment, 771
sowing date, 1414
sowing method, 818
spacing, 1414
thinned v. unthinned, and yields, 1414
varieties, 1637
Branchu....818
Canson....1902
Cavalier....818
Green Marrowstem....1902
Moëllier....818
Purple Marrowstem....1902
Thousandhead....1902
weeds in, 764, 1550
Agropyron repens, 414
Capsella bursa-pastoris, 2010
Chenopodium album, 2010
Stellaria media, 2010
'Kasahui', of potato — see *Stemphylium consortiale*
Kenaf (*Hibiscus cannabinus*)
diseases
Colletotrichum hibisci, 1930
Macrophoma urenae, 1450
irrigation, 855
retting methods compared, 337
/roselle, comp. yields, 856
v. jute, 1450
varieties
Madras Red....1930
Tashgan....1930
Tingo María....855
Xuaneng No. 1....1930
water requirements, 855
Kentucky bluegrass — see *Poa pratensis*
Kenya
crops
Bambarra groundnuts, 202
barley varieties, 1279
cassava, 302
chickpeas, 202
cocoyams, 302
cowpeas, 202
groundnuts, 350
jack beans, 202
Lablab niger (*Dolichos lablab*), 202
lupins, 202
maize, varieties, 1279
niger seed, 350
oats, varieties, 1279
oil-seed flax, 350
peas, 202
pigeon peas, 202
potatoes, 302
varieties, 1373
sesame, 350
soyabeans, 202
sunflower, 350
sweet-potatoes, 302
sword beans, 202
velvet beans, 202
wheat varieties, 1105, 1279
yams, 302
land development, 2028
land reclamation, desert, 1575
Knot-grass — see Weeds, *Polygonum aviculare*
Lablab niger (*Dolichos lablab*), 1631
cropping, mixed, 1210
harvesting, 202
in Fr. overseas territories, 746
in Kenya, 202
seed germination and soil salinity, 1942
seed rate, 202
spacing, 202
Lactuca sp. — see under Weeds
Ladysthumb — see Weeds, *Polygonum persicaria*
Lagenaria vulgaris — see Gourd
Land development
in Australia, 2068*, 1573*
in Kenya, 2028
in New Zealand, 2068*
Land reclamation — see also Soil and water conservation
coastal dunes, Sardinia, 436
desert hinterland, Kenya, 1575
in Bavaria, 1004
in French Oceania, 1576
in India, Punjab, 1577
in Pakistan, Punjab, 1577
in Somaliland, 957
marshland
W. France, 435
Sardinia, 436
Morocco, 437
mined areas, bibl., 955
peat-land, 434, 1004
saline soils, 437, 438, 956, 1575, 1578
sandy soils, 436, 468
Land tenure
in arid regions, 521*
in India, Kerala State, 1591
Land use
in Afghanistan, 431
in Argentina, 432, 951
in Australia, N.S.W., 1598
in Belgian Congo, 1571
in Brazil, Rio Grande do Sul, 2030*
in Brit. Commonwealth, 1569*
in Cuba, 2029*
in Egypt, 431
in France, 433*
in French Oceania, 952
in Gambia, 1078
in Germany, Lower Bavaria, 1572*
in Gt Britain, 430*, 1055*
common land, 954*
statistics, 953*
1870–1956, 2027*
in India
Damodar valley, 1568*
W. Bengal, 425
in Iran, 431
in Iraq, 431
in Jordan, 431
in Lebanon, 431
in Libya, 431
in New Guinea, Chimbu, 426
in Pakistan, 431
in Ruanda-Urundi, 1571
in Sarawak, Iban, 518
in Saudi Arabia, 431
in Sudan, 431, 1570*
in Syria, 431
in Turkey, 431
in USSR, 2026
Landsberg mixture, 2041
Laphygma frugiperda, 1381
Lathyrus maritimus, 1476
L. ochrus, 1631
L. sativus, 109
Leaf — see under Plant(s)
Leaf-area index, 1477, 1483
Leafhopper — see *Macrosteles fascifrons*
Leafy spurge — see Weeds, *Euphorbia esula*
Leatherjacket — see *Tipula* spp.
Lebanon, land use, 431
Legumes (general) — see also individual crops
amino-acid content, 750*
cross-inoculation groups, 749
diseases, virus, 747
fertilizers, 880, 1332, 2043
for silage, 1275
growth and N fixation, 1332
growth substances, gibberellin, effect of, 1486
harvesting date, for silage, 1275
herbicides, MCPP, effect of, 949
in Africa, use of, 1076
inoculation, 1331
nodulation, 749, 751*, 1329, 1331, 1332, 1642*, 2084*
and gibberellin, 1486
pests, aphids, 747
plant density and aphid control, 747
root growth and lime, 880
rotations, 1210
and soil-N deficiency, 2043
and virus disease control, 747
seed, chemical composition, 1822, 2043
sowing date and aphid control, 747
Lens spp. — see Lentils
Lentils (*Lens culinaris* [*esculentum*]), 1631
diseases, 199
food value, 199

growth substances, β-indoleacetic acid, effect of, 201*
in India, U.P., 199
pests, *Bruchus lentis*, 200
varieties, in India, U.P., 199
Leptohylemyia coarctata, 1111, 1661
Leptosphaeria spp., 711
L. salvinii, 1237
Lespedeza sp./maize intercropping, and soil erosion, 465
L. stipulacea, and gibberellin, 1953
Lesser swine cress — see Weeds, *Coronopus didymus*
Leucaena glauca, 749, 1631
Leucania unipuncta, 127
Leuconostoc mesenteroides, 29
Ley(s) — see also individual grasses
and barley nurse crop, 603
and soil organic-matter content, 2039
and subsequent crop, 821, 977, 1115
establishment trials, 1274
nutrient uptake, K, 1963
pest infestation of, and subsequent crop, 1115
undersown, 1582
Liberia, rice mill, 1787*
Libya, land use, 431
Light — see Irradiation, solar, Photoperiodism, Photosynthesis, Plant(s) environment, and individual crops
Linear programming, 1014*
Linseed — see Oil-seed flax
Linum usitatissimum — see Fibre flax and Oil-seed flax
Lodging — see also individual crops
resistance measurement, 1143
Lolium spp., 1280, 1946
L. multiflorum, 435, 603
L. perenne, 1115
L. rigidum, 438, 2066
Long bean — see Cowpeas
Longitarsus parvulus, 331
Longiunguis sacchari, 1215
Loopers — see *Anomis flava* and *Antarchaea chionosticta*
Lophira alata, 1579
Lotus corniculatus, 102, 351
Lucerne (*Medicago sativa*)
and barley nurse crop yield, 603
as green manure, 621, 642
cross-inoculation group, 749
diseases, yellow-top virus, 747
evapotranspiration measurement, 473
fertilizer requirements, 529
growth substances, GA, effect of, 568
herbicides, dalapon, effect of, 414
in USSR, seed production, 1440
light intensity, effect of, 1476
mulches, effect of, on saline soil, 467
nutrient uptake, 1492
on saline soil, 467
rotations, 575
seed production, in USSR, 1440
undersown, with fibre flax, 1924
Lupins (*Lupinus* spp.)
general
as green manure, 450
chemical composition
alkaloid analysis, 1074
Mn localization, 1968
cross-inoculation group, 749
cultivation, on peat soil, and nodulation, 1819
fertilizers, 1819
harvesting, 202
in Kenya, 202
in Poland, 1074
nodulation, on peat soil, 1819
nutrition, 372
on peat soil, 1819
pod-shedding and peduncle diameter, 1074
seed, Mn localization in, 1968
seed rate, 202
spacing, 202
varieties, 1074
L. albus, 1631
flowering and seed size, 197
growth and seed size, 197
seed
chemical composition, 1822
size and growth, 197
surface structure studies, 1511
var. Hadmerslebener early sweet Albus....1074
weather and seed yield, 197
L. angustifolius
seed
damage, harvesting, 198
drying, 198
storage, 198
L. luteus
abscission-accelerators in, 1820*
border protection and virus infection, 745
diseases, bean yellow mosaic, 745
defoliation, 1475
flower abscission, effect of, 1475
growth substances, effect of, after defoliation, 1475
nodule, *Rhizobium lupini* in, and N-fixing micro-organisms, 1997
var. Weiko III....745
L. termis, 1631
Lupinus spp. — see Lupins
Lycopsis arvensis — see under Weeds
Lygus vosseleri, 834
Lysimeter, 473, 991, 992, 1518, 1600, 1735

Machinery, 1064* — see also Agricultural mechanization
Macrophoma phaseoli, 316
M. urenae, 1450
Macrosiphum solanifolii, 1381
Macrosteles fascifrons, 1382
Madagascar
agriculture, 958, 1566
beans, *Phaseolus* spp., 746
climate, 1566
Maecolaspis prasina, 1381
Magnesium (review), 1635 — see also fertilizers and nutrition under indiv. crops

Maize (*Zea mays*)
for fodder, 2041
as catch crop, 2041
as second crop, 2041
as silage, 85, 236, 622, 1173, 1177, 1204, 1275, 1720, 1727, 1734, 1739, 2041, R.A. p. 172
chemical composition, 1720, 1727
cropping
second-, 2042
mixed, 1182
cultivation, 1173
dry-matter determination, sampling technique, 893
earliness and plant population, 1720
fertilizers, 1173
growth substances, GA, effect of, 1734
harvesting date, 622, 1177, 1275
herbicides, effect of, 85
in Bavaria, 1204
in France, 435
in Germany, 2042
in USSR, 1739
irrigation requirement, 79
lodging and plant pop., 1720
on reclaimed marshland, 435
plant population, 1182, 1720
rotations, 236
seed rate, 1727
seed treatment, 1074
sowing date, 236, 1173, 1177, 1727
sowing method, 1173
spacing, 1173, 1727
varieties, 1177, 1182, 1720, 2041
weeds in, 85
for grain
after ley, fertilized, 977
after wheat, 619
chemical composition, 1723, 1740
riboflavin determination, 96
climate and earliness, 1726
cropping, mixed, 625
cultivation, 1173
and weed control, 1731
hoeing, 618, 643
ploughing, 618
stubble-mulching, 619, 1199
subsoiling, 1175
damage by animals and birds, 88
defoliation, 617, 1199
detasseling and yield, 617
diseases, 1203
Fusarium moniliforme, 1201
drought, effect of, 92*, 627, 1742
earing
and drought, 92*
and seed rate, 74
earliness, 1726
evapotranspiration, 1735
fertilizers, 74, 77, 81, 87, 92*, 97, 98, 100, 516, 615, 617, 618, 620, 623, 624, 630, 643, 644, 645, 714, 962, 967, 976, 977, 1007, 1173, 1174, 1175, 1176, 1197, 1198, 1199, 1721, 1731, 1740, 1742, 1744, 1748
v. green manure, 621
flowering, drought during, and yield, 627
frost protection, 1174
grain — see also storage below
chemical composition
amino acids, 95
carotene content and drying, 649
lysine, 95
protein, 95, 649
drying, 581*, 649, 1200, 1737, 2064
moisture content, 648
and growing-season duration, 1724
and insecticide efficacy, 1201
determination, 1506

quality
and position on ear, 516
and storage, 99
ripening, 1739
green manures, effect of, 621, 967
growing-season duration and yield, 1724
growth and N, 1740
growth substances, GA, effect of, 1734
harvesting, 72, 516, 1640*
harvesting date, 622
herbicides, effect of,
simazin, 1730
2,4-D, 1731
in France, distribution, 1726
in Italy, 1748
in USSR, 1739
insecticides, effect of, 1201
interplanting, 1584
irrigation, 79, 87, 624, 625, 626, 1198, 1723
leaf, chemical composition, 636*, 1723
lodging and spacing, 1174
maturity
time to, 1726
indications, 1724
mechanization, 1748
mulches, stubble-, effect of, 619, 1199
nutrition, 1740
on saline soil, 1575
pests, 73, 99, 647, 652, 1606
Calandra oryzae, 651, 1201
Frankliniella sp., 87
Heliothis armigera, 76
Oryzaephilus surinamensis, 650
Pyrausta nubilalis, 76
Rhizopertha dominica, 651
Tribolium castaneum, 650
photoperiodism, 1189*
plant population, 74, 77, 98, 620, 623, 630, 1174, 1199, 1483, 1721, 1748
rainfall, effect of, 623, 627, 1595, 1742
root penetration, 1176
rotations, 620, 623, 967, 976, 1583, 1748
and subsoiling, 1175
seed production, 1748
silking and temperature, 1194
soil drainage, effect of, 78*
soil fumigation, effect of, 1606
soil moisture, effect of, 624, 626, 627, 1198
soil type and yield, 1723
sowing date, 74, 76, 87, 615, 620, 643, 1169, 1171, 1173, 1194, 1595
sowing method, 1173, 1748
spacing, 100, 516, 615, 617, 620, 1171, 1172, 1173, 1174
stalk-cutting and yield, 617
stem, chemical composition, 1723
storage, 72, 73, 646, 647, 648, 650, 651, 652, 1201, 1203, 1747*
and palatability, 99
humidity and pollen-grain respiration, 1188
stover disposal, 617, 620
temperature, effect of, 623, 624, 1188, 1286
temperature requirement, 1194
water requirement, 625, 1174
water-table depth, effect of, 1723
water use, 991, 1735
weeds in, 614, 620, 631, 643, 1730, 1731
Abutilon theophrasti, 83
Amaranthus retroflexus, 83
Convolvulus arvensis, 1730
Cynodon dactylon, 1730
Digitaria spp., 1730
Panicum spp., 1730
Setaria spp., 83, 1730
S. lutescens, 630
S. viridus, 630
Sorghum halepense, 398
Striga spp., 615
general
cells, parenchymatous, structure of, 352
chemical composition
and nutrition, 93
Mn localization, 1968
climate, effect of, 1739, R.A. p. 169
cold resistance, R.A. p. 169
costs, in S. Africa, 654*
cropping, mixed, 1739
cultivation, 1739
for rainfall conservation, 1595
hoeing, 516
on saline soil, 1575
ploughing, 100
/sowing, simultaneous, 614
subsoiling, 645, 1175
tillage depth and root penetration, 1176
damage by animals and birds, 88
diseases, 73, 1016
chlorosis, and root cation-exch. capacity, 1960
seed-borne, 2057
stalk rot, 1743
drought, effect of, 92*, 635
earliness assessment, varieties, 1738
evapotranspiration, 991, 1196, 1600
measurement, 473
fertilizers, 73, 94, 494, 636*, 642, 991, 1739, 1743, 1745
flowering, 1739
varietal characteristics, 91
frost resistance, 359, 1739
green manures, effect of, 642
growth, 516
growth substances, GA, effect of, 1951
herbicides, effect of, 516, 949, 2012
amitrol (amizol), 1195
CDAA, 631, 1561
dalapon, 416, 949
dinoseb, 1562
simazin, 416, 1185
TCB, 416
history of, 89
in Australia, N.S.W., 1719
in Brazil, Rio Grande do Sul (map), 1169
in Hungary, 516
in Mexico, Veracruz, 98
in Morocco, Souss Plain, 422
in N. Rhodesia, 962
in Spain, Seville, 80
in USA, 72
S. Florida, 73, 1174
in USSR
Kazahstan, 622
seed production, 1440
insecticides, methyl bromide, effect of, 1202
intercropping, 1421, 1441(2)
and soil and water conservation, 465, 1597
interplanting, 326, 657
irrigation, 1480, 1722
and seed production, 622
leaf
chemical composition
and yield prediction, 1741
sugar content, 638, 639
diagnosis, 1493
stomata, effect of drought on, 635
weight and sowing date, 638
Mn deficiency, 373
Mn excess, damage, 373
nutrient uptake, 1483, 1493, 1743
nutrition, 93, 372, 637, 1192, 1193, 1493, 1741, 1743
on peat soil, 73
on reclaimed land, 436, 437
on sandy soil, 73
P deficiency, 637
pests, 73, 516, 632
Busseola fusca, 86
Calandra spp., 1202
Sesamia sp., 86, 437
Tribolium spp., 1202
photoperiodism, 1286, 1947
photosynthesis, 359
photothermal requirements and earliness assessment, 1738
plant population, 616, 1196
pollen-grain
germination, 634
respiration, 1188
growth substances in, 90
pollination, 153
races, in Colombia, 1186
radioactive waste uptake, 903
root
cation-exchange capacity, 1960
growth, 1483
system, 1739
rotations, 451, 1647, 1808, 1907
and water conservation, 457
seed
chemical composition, Mn localization, 1968
damage and germination, 1733
drying, 516
fumigants, methyl bromide, effect of, 1288
germination, 1733
and *Azotobacter*, 1943
and fertilizers, 1745
testing, 1187
moisture content and storage, 1746
viability, 351, 1746
seed production, 14, 622, 1440
seed storage, 653, 1288, 1746
seed treatment, 73, 653, 1202, 1732, 1733
and frost resistance, 359
seedling(s)
chemical composition, 1481
drought resistance and labile heredity, 1481

emergence, 75
and soil colour, 1170
growth and labile heredity, 1481
nutrient uptake, 1191
nutrition, 1191, 1481
root growth, 1191
root system, varietal identification by, 1190
winterhardiness and labile heredity, 1481
shoots, side-, treatment of, 516
soil
colour and emergence, 1170
drainage, effect of, 94
moisture, effect of, 75, 1722
pH, effect of, 637
temperature, and emergence, 75
sowing date, 75, 516, 638, 1739
sowing-depth, and emergence, 75
sowing method, 1739
spacing, 616
stem
carbohydrate content, 640*
internodes, successive, chemical composition of, 641
temperature
effect of, 1722, 1739, R.A. p. 169
requirements and earliness assessment, 1738
transpiration, 1196
measurement, 1975
varietal identification by seedling root system, 1190
varieties, 82, 91, 95, 482, 1725, 1729*, R.A. p. 172
for high altitudes, 1184
in America, central, 633
in Europe, hybrids, 1644
in France, 1726
in Italy, 1178, 1179, 1748
in Kenya, 1279
in Mexico, 1183, 1184
in S. Africa, 1728
in USA, S. Florida, 73
in USSR, 1739
specific
American Early....628, 638, 639, 641
Caldera 331....1727
Camelia....96
Caragua....1182
CB. 45....1725
CB.47....1725
Charrua....627
Crows 260....1727
(Cuba Amarillo × Mexico 16) × (Sicaragua × Mexico 16)....653
Diacol V551....629
Dietzche....627
Dixie 33....628
G.H. 53....628
G.H. 90....628
G.H. 92....628
G.H. 93....628
G.H. 96....628
Goudster....1727
H-125....1184
H-126....1184
H-501....98
H-503....98, 1183
H-504....1183
I.A.B. 300....1178, 1748
Ibrido Maliani....1180
Insubria 295....1179, 1748
Italo 225....1180, 1181
Italo 268....1181
Jaune Gros....1177
K8....1907
Kingscroft KF....1727
Krasnodarskaja No. 149....359
Marano Vicentino....626, 1180
Matador....1725
Maygold 99A....626
Mexico 1....653
Mielmais 50....1182
Minnestoa....96
Minnesota A42.645 × WAMRU 2....86
Nostrano dell' Isola....626
No. 3795 Trinidad....653
Ohio 51 A × B8....94
Philippine No. 3....77
Pioneer 355....1727
Pioneer 389....1727
Prior....1725
V-10....1184
W 240....1726
W 355....1726
White Horsetooth....75, 1177
Wisconsin 240....1727
Wisconsin 275....1720
Wisconsin 341A....1720
Wisconsin 355....626
Wisconsin 413....81
Wisconsin 642....81
water use, 975, 1196, 1480, 1600, 1736
weeds in, 84, 937, 1185, 1540, 2012
Agropyron repens, 1185
Cirsium arvense, 1185
Convolvulus arvensis, 1185
Cyperus esculentus, 396
Equisetum arvense, 1185
Mentha arvensis, 1185
Setaria spp., 1540
Taraxacum officinale, 1185
Tussilago farfara, 1185
Urtica spp., 1185
winterhardiness, 1739
yield prediction, by leaf analysis, 1741
Z. mays conv. *microsperma*, 2042
sweet-corn
cultivation, ploughing and weed control, 101
herbicides, effect of
ATA, 101
dalapon, 102
dinoseb, 655
TPA, 102
2,4-D, 655
insecticides, sevin, effect of, 1206
leaf, chemical composition and yield prediction, 1741
nutrition, 1741
pests
Heliothis zea, 1206
Pyrausta nubilalis, 1207
plot size, and yield, 656
seed-setting failure, causes of, 1749
silking and temperature, 1749
sowing date, 101
temperature and silking, 1749
varieties, 655
weeds in
Agropyron repens, 101
Chenopodium spp., 655
Cyperus esculentus, 395
Polygonum convolvulus, 655
P. persicaria, 655
Setaria spp., 655
yield prediction, by leaf analysis, 1741
Malachra capitata/roselle, comp. yields, 856
Malaya
jute, 336
rice, 700*, 1786(1)
Manganese and plant nutrition, 1497* — see also fertilizers and nutrition under indiv. crops
Mangels (*Beta vulgaris*)
cells, parenchymatous, structure of, 352
S deficiency, 883
seedling identification, 1346
seed testing, 1348
thinning, 762
double plants and yield, 762
Mangold fly — see *Pegomyia hyoscyami betae*
Manihot utilissima — see Cassava
Mapping, arid regions, 521*
Maps
Africa, 1075
Belgian Congo and Ruanda-Urundi, land use, soils, and veget., 1571
Gambia, land use and vegetation, 1078
Principe and São Tomé Is, climate, soils and vegetation, 2021
Sudan, land use, 1570*
vegetation, 1567, 1634
America, North, water balance, 2049*
Brazil, Rio Grande do Sul, maize, 1169
Canada, frost severity, 1602
Gt Britain, climate, 1060*
world, atmospheric water vapour pressure, 1601
Marrow-stem kale — see *Brassica oleracea* var. *acephala*
Marshland — see also under Land reclamation
water-balance studies, 484
Matki (*Phaseolus aconitifolius*), seed rate and soil and water conservation, 2046
Meadow fescue — see *Festuca pratensis*
Medicago lupulina — see Black medick
M. sativa — see Lucerne
Melampsora lini, 1445
Meligethes sp., 1462
Melilotus spp. — see Sweet-clover
Meloidogyne incognita, 1895
M. incognita acrita, 214, 314
Melolontha melolontha, 2061
M. vulgaris, 1114
Melon (*Cucumis melo*), interplanting, 657
Mentha arvensis — see under Weeds
Meromyza spp., 1115
Mexican marigold — see Weeds, *Tagetes minuta*
Mexico
broom corn, 1212
maize, 98

varieties, 1183, 1184
potatoes, varieties, 1370
sorghum, varieties, 1213*
wheat
fertilizers, in Yaqui Valley, 36
for fodder, 1092
Micrometeorology, 2054* — see also Plant(s), environment
Micronutrients (general), 358, 374* — see also Fertilizers and Plant(s), nutrition
and chelating agents, 1498*
B, review, 885
Cl, 882
Cu, 1965
deficiency diagnosis, 886
determination, spectrochemical, 384
/fungicide seed treatment, 155
in crop plants (review), 887*
Mg (review), 1635
Mn, 1497*
synthesis within plant, 1967
Millets—see also Sorghums
Echinochloa sp., for silage, 1275
E. crus-galli var. *edulis*, in Queensld, 1219
E. crus-galli var. *frumentacea*, in Queensld, 1219
Eleusine coracana
ethnobotany, 1220
fertilizers, 1221
history, 1220
in S.W. Sudan, 1221
nomenclature, 1220
pests, *Leucania unipuncta*, 127
Panicum miliaceum
for fodder, 2042
growth, 1756
in Australia, Queensld, 1219
in Germany, 2042
inflorescence development, 1756
seed-bed preparation, 1219
seed rate, 1219
weeds in, 1219
Pennisetum spp.
grain, amino-acid content, 1217*
P. glaucum
evapotranspiration and yield, 991
fertilizers, 991
germination, 1957
water use and evapotranspiration, 991
P. typhoideum
branching and flowering, 103
cultivation on saline soil, 1575
flowering and branching, 103
in Australia, Queensld, 1219
on saline soil, 1575
photoperiodism, 103
seed-bed preparation, 1219
seed rate, 1219
weeds in, 1219
Setaria italica, 701
climate, effect of, 1757
drought resistance, 66
flowering
and climate, 1757
and light quality, 380
for fodder, 2042
grain number and soil moisture, 1757
growth and plant container, 1482
in Australia, Queensld, 1219
in Germany, 2042
light, incandescent v. fluorescent, and growth, 380
nutrient uptake and plant container, 1482
photoperiodism and supplemental light, 380
seed-bed preparation, 1219
seed rate, 1219
seed treatment and drought resistance, 66
soil moisture, effect of, 1757
stem growth and light quality, 380
temperature, effect of, 1757
varieties, 1757
weeds in, 1219
S. italica var. *purpurea*, in Australia, Queensld, 1219
Millipede — see *Blaniulus guttulatus*
Morocco
agriculture, Souss Plain, 422
crops
barley, 422
cotton varieties, 1441(3)
maize, 422
rice varieties, 118
wheat, 422
land reclamation, Rharb, 437
vegetation, Doukkala, 1526
Mosaic — see under individual crops
Mucuna pruriens var. *utilis*, inoculation, 1331
Mucuna utilis, root excretions, 748
Mugwort — see Weeds, *Artemisia vulgaris*
Mulches — see also individual crops
and soil conservation, 1554
on saline soils, 467
Mung — see Beans, *Vigna mungo*
Mustard — see also under Weeds, *Brassica* spp.
as green manure, 450
Brassica juncea
fertilizers, 1936*
for fodder, 2042
harvesting, 869
in Germany, 2042
insecticides, effect of, 348
oil
chemical composition and harvesting date, 869
content and P, 1936*
pests
Ceuthorhynchus spp., 1462
Meligethes sp., 1462
Rhopalosiphum pseudobrassicae, 348
seed treatment, 1462
seedling, anthocyanin formation and light, 349
shedding, 869
var. Trowse....1462
B. nigra
harvesting, 869
identification, 1993
oil, chemical composition and harvesting date, 869
seedling, anthocyanin formation and light, 349
shedding, 869
Sinapis alba
cropping, mixed, 1821
diseases, leaf chlorosis, 888
growth substances, xanthozillin, effect of, 1956
harvesting, 869
oil, chemical composition and harvesting date, 869
root
geotropism, 1945
growth substances in, 1945
-hair growth and xanthozillin, 1956
seedling, anthocyanin formation and light, 349
shedding, 869
Myrica gale, N fixation, 1469
Myzus persicae, 215, 1345, 1381, 1382
Napier fodder — see *Pennisetum purpureum*
Nassella trichotoma — see under Weeds
Nematocides — see Insecticides
Net assimilation rate — see under Plant(s) and individual crops and spp.
Netherlands
fibre flax, 1923
irrigation, 2031*
lupins, on peat soil, 1819
lysimeters, 992
Mn nutrition, research on, 1497*
sugar-beet varieties, 209
Netherlands New Guinea, rice, 117
New Guinea, agriculture, 426 — see also Netherlands New Guinea
New Zealand
climate, 994*
land development, 2068*
plant introduction, 2068*
potatoes, varieties, 1369
weed introduction into, 2007
Nicaragua, maize varieties, 633
Niger seed (*Guizotia abyssinica*), in Kenya, 350
Nigeria, fallowing, 1579
Nitrogen utilization by plant, 2084 — see also under Legumes and individual crops
Nodulation — see under Legumes and individual crops
Nomenclature, 522
Avena spp., 1281
cereals, in Africa, 151
fertilizers, 1056
herbicides, 2011
Indigofera spp., 1281
millet (*Eleusine coracana*), 1220
pests, glossary of, 1049
plant associations, in Africa, 1634
plant disease, glossary of, 1049
Pteridophyta and Spermatophyta, Chinese/English names, 1054
sesame, 860
Solanum spp., in Argentina, 1881*
teff, 1220
Triticum spp., 1281
varieties, 1998
weeds, 1551, 2006, 2081
Noogoora burr — see Weeds, *Xanthium pungens*
Norway
barley, varieties, 1277
climate, in Ås, 480
kale, 1414
oats, varieties, 1277
potatoes, varieties, 237
wheat, varieties, 1277
Nuclear energy, 901, 1059*, 1522* — see also Irradiation, Radio-

isotopes and Radioactive-fallout and -waste
Nunbank setaria — see Millets, *Setaria italica* var.
Nutgrass — see Weeds, *Cyperus esculentus* and *C. rotundus*
Nutrition — see under Plant(s) and individual crops
Oats (*Avena* spp.), 593
for fodder
as silage, 1275
clipping, effect of, 1789
fertilizers, 159, 1687, 1789
harvesting date, 587, 1275
in Australia, N.S.W., 1687
Mn deficiency, varietal susceptibility to, 42, 596
seed rate, 1687
sowing date, 587, 1687
spring oats, grown in winter and irrigated, 1134
varieties, 1687
for grain
chemical composition
N, 1699
protein content and fertilizers, 1700
clipping, effect of, 1789
competition, effect of, 1160 — see also plant population and weeds below
costs, in Scotland, 48, 599, 1147
cropping, mixed, 741, 1821
culm — see stem below
diseases, *Erysiphe graminis*, 1702
drying, 161, 588
ear, X-ray observation of, 1513
fertilizers, 52, 158, 159, 598, 714, 1287, 1687, 1703, 1789, 1800
flowering and heat damage, 1284
frost, effect of, 586, 702
frost resistance and fertilizers, 1800
grain — see also drying above
chemical composition
and leaf nutrition, 1702
Ca and phytin, 45
fat content, 46
Mg and phytin, 45
N, 1700
from blasted panicles, 1695
phytin, 45
protein content, and mixed cropping, 741
damage and storage, 1145
husk proportion and fat content, 46
moisture content and storage, 1145
number
and heat damage, 1284
and N, 1700
size and fat content, 46
1000-grain weight, 702, 1700
weight, from blasted panicles, 1695
growth
and seed size, 702
and temperature, 1694
harvesting
combine-, 1145
varieties suitable for, 1692
swath-, 588
harvesting date, 702
herbicides, effect of, 949
in Australia, N.S.W., 1687
irrigation, 1586
leaf nutrition, 1702
lodging
resistance, 594
yield-loss determination, 1697
nutrient translocation and lodging, 1697
nutrition, 1700
on peat land, 1703
panicle(s)
blasted, 1695
characters and plant population, 47
pests, 651
photoperiodism, 1286
plant population, 47, 586
rainfall and yield, 1790
rotations, 598
seed
fumigants, methyl bromide, effect of, 1288
germination, 44, 1288
size, 702, 1090
seed-bed preparation, 586
seed production and harvesting date, 702
seed rate, 47, 1687
and germination rate, 44
sowing date, 586, 1090, 1687
spikelet(s)
number
and seed-bed preparation, 586
and seed rate, 47
sterility, on blasted panicles, 1695
stem(s) — see also lodging above
characters
and lodging resistance, 594
and plant population, 47
fruitful, no. of, and seed-bed preparation, 586
storage, 651, 1145
temperature, effect of, 1286, 1694, 1790
heat damage and flowering, 1284
tillering and N, 1700
general
chemical composition
and fertilizers, 1698
Ca, 1701
Mg, 1701
P, and growth, 45
Co excess, effect of, 1962
Cu excess, effect of, 1962
cultivation, 1047
and soil moisture, 365
diseases, 1016, 1047
Erysiphe graminis, 1690
Ophiobolus graminis v. *avenae*, 1690
Puccinia spp., 1690
Pyrenophora avenae, 1690
seed-borne, 2057
Ustilago avenae, 591
drought resistance, 365
experimental method, field data analysis, 1012
fertilizers, 37, 43, 358, 365, 597, 1007, 1047, 1613, 1698, 1701, 1798
green manures, effect of, 598
growth substances, effect of,
GA, 1951
2,3,5-triiodobenzoic acid, 1490
2,3,6-TBA, 1490
2,4,-D, 1490
2,6-dichlorobenzoic acid, 1490
herbicides, effect of,
dalapon, 416
dinoseb, 1562
MCA, 2013
MCPA, 67, 1489
2,4-D, 67, 1489
in Gt Britain, 1047
Scotland, 1137
irradiation, effect of, 1693
irrigation, 974
leaf diagnosis, 1493
lodging resistance, 1143, 1696*
Mn deficiency, 43, 373
varietal susceptibility to, 42, 596
Mn excess, effect of, 373, 1962
Na, exchangeable, tolerance to, 1798
Ni excess, effect of, 1962
nomenclature, in Africa, 151
nutrient uptake, 1144, 1493
nutrition, 358, 595, 1142*, 1144, 1493, 1496
on reclaimed land, 435
on saline soil, 438
pests, 1047, 1606
Ditylenchus dipsaci, 592, 1139, 1690
Oscinella frit, 1140, 1141, 1690
photoperiodism, 1283, 1694
plant population, 1483
root(s)
absorptive and excretory activities, 1938
cation-exchange capacity, and nutrition, 1962
development and soil aeration, 365
excretion and soil Mn, 1142*
rotations, 1647
and *Thrips angusticeps*, 1929
seed
dormancy-breaking, 44, 706
germination, 44
and irradiation, 1693
identification, 1535
irradiation, effect of, 1693
viability, duration of, 351
seed-bed preparation, 586
seed rate, 47
seed storage, 44, 1145, 1288
seedling
geotropism and growth substances, 1490
vigour and irradiated seed, 1693
soil fumigation, effect of, 1606
sowing date, 586
sowing method, 1047
spacing, 1274
tillering and seed rate, 47
undersown with ley, and spacing, 1274
varieties, 482, 703, 1137
and altitude, 705
for combine-harvesting, 1692
in Argentina, 41*
in Australia, N.S.W., 1687
in Gt Britain, 1047
in Kenya, 1279
in mountain areas, 1277
in Norway, 1277
in Sweden, 1146

in USA
N. Carolina, 1792
N. Dakota, 704*
S. Illinois, 590*
lodging-resistant, 1143
mixtures and yield, 47
specific
A.20....148
Aa. 729....1136
Abed Max....1138
Abed Palu....1138
Abegweit....1564
Avon....42, 596
Ayr Commando....1136
Ayr Line Potato....1136
B.4....148
Bamboo II....1703
Bambu....1277
Beaver....1564
Blanche de Wattines....1690
Blenda....148, 158, 592, 1135, 1136, 1689, 1703
Bonstar....148
Bördeweiss....1692
C.I. 5154....1143
C.I. 5155....1143
C.I. 7317....1143
C.I. 7318....1143
Cappelle....435
Civena....1690
Craigs Afterlea....148
D.32....148
Dale....42
DB.10....148
Eagle (Ørn)....1136, 1139, 1689
Exeter....1564
Extra Klock II....589
Flamande-Desprez....1690
Forward....1689, 1691
Fulghum....596
Glasnevin Potato....148
Glasnevin Triumph....148, 1689
Goldhafer II....1692
Grey Winter....47
Hadmerslebener Auswuchsfester Gelb....1692
Hein II....1277
Kent....596
L.275 — see Stormont Sceptre
Lorain....1564
Lightning....1136, 1691
Maldwyn (S221)....47, 1135, 1689, 1691
Markton....1134
Marne....1136, 1138, 1276, 1691, 1703
Marvellous....47
Mass Selection D....148
Milford....47, 1135, 1136, 1689
Minor....1136, 1139, 1691
Nidar II....1277
Opus II....1135
Orion III....1689
Ørn — see Eagle
Palu....158, 592, 1136, 1690 1691
Pegase....1138
Pendek....148, 1138, 1690
Penrhyn....1135, 1651, 1688
Perle....1277
Picton....1135
Potato (Ardee)....148
Powys (S226)....47, 1135, 1688
Primus....1689
Primus II....1691
Reagle....1691
Rex....148, 1136, 1139
S84....148
S147....47, 1135, 1688
S172....47, 586, 1135, 1688
S220....1691
S221 — see Maldwyn
S226 — see Powys
Silber II....1138
Silver....592
Sisu....1136, 1690
Sol II — see Sun II
Stål — see Steel
Star....1136, 1689
Steel....1276
Steel A....1138
Stormogul II × Extra Klock I....589
Stormont Sceptre (L.275)....1276
Strind....1277
Sun II (Sol II)....148, 592, 1135, 1136, 1689, 1690, 1691
Svalöf Vg 01534f....1138
Universal....1692
Victory....47, 1564
Vigor....1138
Voll....1703
vernalization, 1283
water balance, factors affecting, 365
weeds in, 413, 559, 707
Agropyron repens, 708
Avena spp., 707
A. fatua, 2000
Brassica arvensis, 707
Chondrilla juncea, 926
Polygonum convolvulus, 707
Sinapis arvensis, 413
winterhardiness, 47, 1283
Zn excess, effect of, 1962
Oil crops (general) — see also individual crops
in India, Andhra Pradesh, 1937*
Oil-seed flax (*Linum usitatissimum*)
chemical composition, Mn localization, 1968
diseases, 1016
Alternaria linicola, 1447
seed-borne, 1447, 2057
fertilizers, 342, 863
growth substances, xanthozillin, effect of, 1956
harvesting, 350
harvesting date, 849, 862
herbicides, effect of,
CDAA, 910
CIPC, 949
IPC, 910
in Kenya, 350
in Spain, 1933*
in USA, N. Dakota, 704*
nutrition, 1496
oil
content, 342, 861
formation, 862
iodine value, 861, 862
plant population, 1483
root-hair growth and xanthozillin, 1956
seed
chemical composition — see also oil above
chlorophyll content, 862
Mn localization, 1968
sugar content, 862
seed rate, 350
seed treatment, 1447
sowing date, 861
spacing, 350
varieties
in India, 1934, 340
in USA, N. Dakota, 704*
specific
Baladi....862
Charrúa M.A.G.....341
Cross 4-29....340
Hindi....861, 862, 863
Oliveras Toba M.A.G....341
P.330 M.A.....341
Pergamino Pampa M.A.G. 341
Pergamino Puelche M.G.A. 341
Querandí M.A....341
T.126....1934
Tezanos Pinto Entrerriano M.A.G....341
weeds in, 707
Agropyron repens, 708
Avena spp., 707
A. fatua, 2000
Brassica arvensis, 707
Digitaria sanguinalis, 1454
Polygonum aviculare, 1454
P. convolvulus, 707
Olea spp. — see under Weeds
Onopordon acanthium — see under Weeds
Ophiobolus graminis, 711, 1660
O. graminis v. *avenae*, 1690
Opomyza spp., 1115
Ornithopus sativa — see Serradella
Orobanche spp. — see under Weeds
Oryza spp. — see Rice and under Weeds
Oryzaephilus surinamensis, 650
Oscinella spp., 1115
O. frit, 1140, 1141, 1690
Osmosis — see under Plant(s)
Oxalis spp. — see under Weeds
Pachymerus acaciae, 1312
Pachypodium spp. — see under Weeds
Pacific Islands, climate, data, 476*
Pakistan
cotton varieties, Multan, 307
land reclamation, Punjab, 1577
land use, 431
Palloura — see Weeds, *Zizyphus lotus*
Panama, maize varieties, 633
Panicum crus-galli — see under Weeds
P. antidotale, 2046
P. maximum, 451
P. miliaceum — see under Millets
Papaver hybridum — see under Weeds
P. somniferum — see Poppy
Paraguay, rice, 143
Parthenium hysterophorus — see under Weeds
Paspalum dilatatum — see under Weeds
P. vaginatum, 467 — see also under Weeds
Passer domesticus, 1753

Pearl millet — see Millets, *Pennisetum glaucum*
Peas (*Pisum* spp.)
as green manure, 1647
canning, 186, 733, 739, 1320
^{60}Co intake and accumulation, 904
cross-inoculation group, 749
cultivation, 1056
diseases, 184
chlorosis, 888, 1324
Fusarium oxysporum f. *pisi*, 737
yellow-top virus, 747
dry-matter accumulation and temperature, 1324
ensiling, 186
fertilizers, 184, 186, 738, 1056
flowering, 1642*
growth and temperature, 1324, 1949
growth substances, effect of, 371, 1952
gibberellin, 190, 370, 1951, 1952
IAA, 370
harvesting, 184, 186, 202, 1056
harvesting date, 739
herbicides, effect of,
allyl alcohol, 735
CDAA, 192, 910
CDEC, 192
dinoseb, 734, 1320, 1321, 1562
4-(MCPB), 2014
IPC, 192, 910
MCPA, 1320
MCPB, 734, 949, 1321
MCPB, 734, 949, 1321
propham, 949
TCA, 192
2,4-D, 1320
2-(MCPP), 2014
2-(2,4,5-TP), 2014
in Argentina, 186
in Gt Britain, 184
in Kenya, 202
insecticides, effect of
on crop quality, 1610
thimet 44D, 192
leaf
chemical composition and chlorosis, 888
respiration and light, 1470
surface structure studies, 1511
light, effect of, 370, 1470
light intensity and plant surface structure, 1511
maturation, 189
Mn deficiency, 373
Mn excess, damage, 373
Ni toxicity, effect of, 888
nodulation, 191, 738, 1642*
nutrition, 372
P. arvense, 191, 1631, 1642
P. sativum, 186, 190, 373, 888, 904, 1511, 1631, 1945, 1951, 2043
pests, 184
Acyrthosiphon pisum, 747
Persectania ewingii, 488
Sitona sp., 192
photoperiodism, 1642*, 1947
photosynthesis, 1470
plant population, 1319
plot size, and yield, 656
radioisotope accumulation in, 904, 1990
root(s)
cation-exchange capacity, 1959
geotropism, 1945
growth, factors affecting, 1324, 1974
growth substances in, 1945
rotations, 186, 737, 960, 2043
seed
chemical composition, protein content, 1333
germination, 189
testing, 1815
size, 1319
seed-bed preparation, 185, 1056
seed production, 733
seed rate, 184, 192, 202
seedling(s)
growth substances, GA, effect of, 190
vigour and fluctuating temperature, 1949
shelling, 186
soil type and rooting, 1974
sowing, 1056
spacing, 192, 202, 732, 1319
stem
growth, 370
surface structure studies, 1511
temperature, effect of, 1322, 1323, 1324, 1949
varieties, 737, 1813, 1814
Alaska....733
Black-eyed Susan....191
Canner's Perfection....739
Celsior....733
Finette....733
Gregory's Surprise....739
Juwel....733
Kelvedon Wonder....733, 739
Lincoln....192, 739
Mansholt's X 2117....733
Monarch Canner....739
New Zealand....191
Pauli....733
Rondo....187
Satellite T.P.....187
Telephone....190
Wando....739
Witham Wonder....739
vernalization and flowering, 1642*
weather and seed-bed preparation, 185
weeds in, 184, 188, 734, 735, 1320, 1553, 2014
Avena spp., 192
A. fatua, 1999, 2000
Brassica hirta, 736
Chenopodium album, 1321
Polygonum aviculare, 732, 1321
P. convolvulus, 732
Raphanus raphanistrum, 1321
Rumex sp., 1321
Setaria italica, 736
S. viridis, 1540
Spergula arvensis, 1321
Stellaria media, 732, 1321
Veronica sp., 1321
Pegomyia betae, 1832
P. hyoscyami betae, 1831
Penicillium spp., 40
Pennisetum spp. — see under Millets
P. glaucum — see under Millets
P. purpureum, 451, 821, 975, 2046
P. typhoideum, 1942
Pepper (*Capsicum* spp.), interplanting, 657
Perennial peppergrass — see Weeds, *Cardaria draba*
Perennial sowthistle — see Weeds, *Sonchus arvensis*
Perilla ocymoides, 1465
Persectania ewingii, 488
Persicaria — see Weeds, *Polygonum lapathifolium*
Peru
cañihua, 1272
cotton, 1418
irrigation, soil levelling for, 970*
potatoes, fertilizers, 804
Pests — see also individual spp. and under individual crops
and K deficiency, 1494
Phalaris sp., 401
Ph. arundinacea — see under Weeds
Ph. canariensis, for fodder, in Germany, 2042
Ph. tuberosa, 467, 2066
Phaseolus aconitifolius — see Matki
Ph. aureus — see under Beans
Ph. mungo — see under Beans
Ph. radiatus — see under Beans
Philippines
rice, 112, 120, 123
shifting cultivation, 517
Phleum pratense, 473, 1280, 1924
Phoma sp., 1447
Ph. betae, 1829, 1830
Photoperiodism — see under Cereals, Plant(s) and individual crops
Photosynthesis — see under Plant(s) and individual crops
Phototropism — see under Plant(s) and individual crops
Phragmites communis — see under Weeds
Phyllotreta spp., 769, 771
Phytophaga destructor, 562
Phytophthora spp., 1009, 1293, 1891
Ph. infestans, 254, 515, 777, 781, 787, 1366, 1370, 1371, 1377, 1586, 1853
Ph. vignae, 166
Phytotrons, 1984*, 1985
Picnomon acarna — see under Weeds
Pigeon peas (*Cajanus cajan* [*indicus*]), 1631
harvesting, 202
in Kenya, 202
intercropping, 1597
leaf, Zn content, 1970
rotations, 451
seed rate, 202
spacing, 202
Pink bollworm — see *Pectinophora gossypiella*
Pinto bean — see Beans, *V. faba* var.
Piricularia oryzae, 120, 126
Plant(s) — see also individual crops and plants
analysis, 892*
B, 1509*, 1640*, 1976*
^{140}Ba, 1979
carbohydrates, 894
carotenoids, leaf, 1510*
chlorophyll, 382,* 1996
^{137}Cs, 1979
dry matter, 893
Mg, 1977*
Mn, 1978
micronutrients, 384
Mo, 1978
N, 1507*

radioactivity determination, leaf proteins, 1508
Se, 1978
^{89}Sr, 1979
^{90}Sr, 1979
Zn, 892,*1978
carbohydrate metabolism, 358, 2068*
chemical composition, 389 — see also analysis above
alkaloids, 1500, 2084*
amino acids, 1501*, 2084*
and insect pests, 523
anti-fungal substances, 523, 889*
Ca, and soil Ca, 1989*
Mn, 1969
micronutrients (review), 887*
nucleic acids, 2084*
phytotoxins, 523
Sr, 1989*
synthesis of elements within plant, 1967
competition, 1525 — see also under **Weeds**
containers, influence on growth, 1482
culture
apparatus, 1514*
technique, 375, 378, 1503*
diffusion pressure deficit measurement, 381
environment — see also **Climate** and **Weather**
control, 1515, 1984*, 1985—see also culture above and **Apparatus**
drought resistance, 1494
and micronutrients, 358
frost resistance, 359, 360, 1494
light, 993* — see also photoperiodism and photosynthesis below and **Irradiation**. solar
and net-assim. rate, 1476, 1477
coloured, and growth, 361*
energy and photosynthesis, 1512
intensity, 363*
supplementary, use of, 896
winterhardiness, 1494
of plants with labile heredity, 1481
studies and temp. recording, 2050
geotropism and growth substances, 1490
growing season, 1477, 1603
growth, 2083
and atmospheric CO_2, 1995
and coloured light, 361*
and plant container, 1482
and labile heredity, 1481
and nucleic acids, 2084*
and population, 1483
and soil properties, 527
and solar radiation, 1477
and wind speed, 1484
heredity, labile, 1481
irradiation, effects of — see **Irradiation**
K deficiency, 1494
diagnosis, 529
leaf
area and crop yield, 870
-area measurement, 1505, 1981, 1982
chemical composition and chlorosis, 888
carotenoids, determination, 1510*
chlorophyll content, 1996
protein, radioactivity determination, 1508
Zn content, 1970
chlorotic, chemical composition, 888
diagnosis, 636*, 637, 1394
growth, optimal rate, and yield, 871
nutrition, 358, 1965
optical properties, 1983, 1996
senescent, abscission-accelerating substance in, 1955*
stomata studies, infiltration technique, 895
surface structure studies, 1511
water content, 1971*
moisture stress and electrical resistance, 379
N fixation, 2084* — see also under **Legumes**
in non-leguminous plants, 1468, 1469
N metabolism, 2084*
N utilization, 2084
net assimilation rate and light, 1476, 1477
nutrient
deficiencies, 2069*
translocation — see translocation below
uptake, 389, 528, 899, 1482, 1492, 1964* — see also **Radioisotopes**, uptake in plant
nutrition, 540*, 870, 879, 1494, 1497*, 1498*, 1965, 1966*
and transmutation of elements, 1967
osmosis, 1472, 1473, 1474
oxidation-reduction process, 358, 359
photoperiodism, 363*, 364, 1465
photosynthesis, 528, 870, 871, 1465
and light energy, 1512
potential, calculation of, 1940*
studies and use of tracers, 386*
phototropism and growth substances, 1490
pollen vitality determination, 1973*
protein synthesis, 1466*, 1939, 2084*
radioisotope accumulation — see under **Radioisotopes**
respiration, 1995
roots(s)
cation-exchange capacity, 1959
culture technique, 378, 1503*
excretions, 748, 1640
growth, 880, 1483
length determination, 1504
O_2 requirement, 354
sampling unit, optimum size, 498
shoot apex, studies of, 1980*
stem, surface structure studies, 1511
tissue culture, GA-like substance from, 371
translocation, 355, 387, 528, 899
transpiration, R.A. p. 1 — see also **Evapotranspiration**
and micronutrients, 358
measurement, 1975
variability of individual, 498
water regime, 870, 877, 878, 879, 1474, 1640*
water requirements, 877, 1587
water use, 876, 990, 1480
winterhardiness — see environment above
Plant breeding, 522, 528
Plant disease — see also individual diseases and crops
seed-borne, 2057
Plant indicators, 1526, 1612
Plant introduction, Aust. and N.Z., 2068*
Plant protection
bibliography, 490, 531*
in Africa, list of specialists, 503*
in India, Madras State, 2063*
Plasmodiophora brassicae, 486
Ploughing — see under Cultivation
Pluchea lanceolata — see under Weeds
Poa pratensis, 568, 1115, 1924, 1975
Poland
agriculture, 2020*
lupins, 1074
Pollen beetle — see *Meligethes* sp.
Polygonum spp., germination, 920, 927, 928 — see also under Weeds
Polypogon monspeliensis, 467
Polyspora lini, 1447
Pongamia glabra, as green manure, 978
Poppy (*Papaver* spp.)
in Italy, 1935
varietal identification, 1463
Portugal, rainfall, 477*
Portuguese Guinea
agriculture, 424*
rainfall, 478*
Portulaca oleracea — see under Weeds
Potatoes (*Solanum* spp.), 1883, 2069*
after catch crops, 236
altitude
and harvesting date, 257
and leaf growth, 794
breeding, 1882*
chemical composition, NPK, 1392, 1394
Cl deficiency, 265
costs
in Scotland, 1406
pre-packing, 807*
cropping, arable, duration of, and yield, 2040
cultivation, 773, 1009, 1884*
damage to tubers during, 1890
mechanized, and soil fertility, 277
ploughing, deep, 774
requirements, 226
cytogenetic studies, 276*
defoliation — see haulm destruction below
diploids, cytogenetic studies, 276*
diseases, 226, 228, 251*, 515, 1363
Actinomyces scabies, 1849
Alternaria solani, 1366
Corynebacterium sepedonicum, 245
Erwinia spp., 245
E. atroseptica, 1400
Fusarium spp., 1888
mildew, 1407
Phytophthora infestans, 254, 515, 777, 781, 787, 1009, 1366, 1370, 1371, 1375, 1377, 1586, 1852, 1853, 1891
purple-top wilt, 1382
Rhizoctonia sp., 788, 1855
Rh. solani, 253, 1366, 1376
Rosellinia sp., 1378
Stemphylium consortiale, 1377

Streptomyces spp., 789
S. scabies, 252, 1854
virus, 245, 522, 788
B, 1366
leaf-roll, 790, 791
mosaic, 790
Y, 1366, 1382
drought, effect of, 234, 802, 1847*
earliness, 1865, 1869
emergence and seed-tuber size, 1362
fertilizers, 228, 232, 264, 277, 278, 494, 515, 529, 773, 789, 798, 799, 800, 801, 802, 803, 804, 1009, 1382, 1392, 1393, 1394, 1399, 1406, 1876, 1884*, 1885, 1963, 2038
flowering, 261, 792*, 1389, 1866
foliar nutrition — see leaf, nutrition below
for crisps, 1399, 1403, 1886
for fodder, 773
frost damage and soil moisture, 235, 1849
fungicides, effect of, 253
aardisan, 1376
aretan, 1376
PCNB, 252, 253
UF-85, 252
$ZnSO_4$, 254
green manures, effect of, 277, 789
growth, 1009, 1392, 1866
and flowering, 261
and photoperiod, 792*, 1389
and seed-tuber size, 1362
and soil aeration, 264
and soil moisture, 1879
and temperature, 1869, 1879
and water use, 233
in vitro, 1391
second-, 781
growth substances, effect of, — see also under seed potatoes below
agromycin, 1385
aretan, 1385
ATA, 266
CIPC, 266, 1859
dalapon, 1860
DCA, 1860
gibberellin, 267, 268, 269, 793, 1386, 1857, 1858, 1859
IAA, 1860
IPC, 1880
kinetin, 1386
MENA, 281
MH, 266, 267, 270, 286, 1873
MH-30, 1872
NAA, 1859, 1860
O-methyl threonine, 266
streptomycin, 1385
TCNB, 281
TIBA, 1860
2,4-D, 270
urethane, 282
harvesting, 228, 302, 515, 773, 780, 805*
damage to tubers, 1890
harvesting date, 237, 257, 777, 790, 1363, 1392, 1865
haulm destruction, 779, 787, 788, 790, 1843, 2013
and blight control, 781
and seed-tuber production, 1871
and subsequent sprouting, 1384
herbicides, effect of, 786
alanap, 247
arsenite, 788
CDAA, 246
CDEA, 247
CDEC, 246, 247
CDT, 246
dalapon, 246, 247, 249, 949, 1321
dinoseb, 246, 785, 788
diuron, 247
DNC, 788
EPTC, 246
MCPA, 250, 785, 949, 1321
MCPB, 949, 1321
4-(MCPB), 2014
MH, 250
monuron, 246, 785
natrin, 247
neburon, 246
No. 3Y9, 247
PCP, 788
simazin, 246, 249
2-(MCPP), 2014
2,3,6-TBA, 249
2,4-D, 246, 250
2,4,5-T, 250
2-(2,4,5-TP), 2014
in Algeria, 230
in Australia, 1892
in Belgian Congo, 1363
in Colombia, 228
in Cyprus, 227*
in India, 515, 1641
in Kenya, 302
in New Zealand, 1369
insecticides
and crop quality, 1610
and flavour, 1396
effect of, 255, 2058
interplanting, 335
irrigation, 233, 234, 774, 776, 1363, 1586, 1844, 1845, 1846, 1847*, 1849
K deficiency, 802, 1494
leaf
area, and heat and water balance, 2048
chemical composition
and planting date, 1866
caffeic-acid content, 795
chlorogenic-acid content, 795
diagnosis, 1394
growth and altitude, 794
nutrition, 278, 1702
peroxidase activity, and blight resistance, 1852
radiation reflexion, short-wave, 2048
light and growth, 1866
lighting, supplementary, use of, 896
mycorrhiza-like structure in tissues of, 1391
nutrient uptake, 270, 1393
on clay soil, 801
pests, 226, 228, 515, 2058
Agriotes sp., 255, 1379
Agrotis ypsilon, 1381
aphids, 257
Dycinetus sp., 1381
Epicauta atomaria, 1381
Gnorimoschema operculella, 256, 1381
Heterodera sp., 245
Laphygma frugiperda, 1381
Macrosiphum solanifolii, 1381
Macrosteles fascifrons, 1382
Maecolaspis prasina, 1381
Myzus persicae, 1381, 1382
Premnotrypes solani, 1380
Pseudococcus maritimus, 1381
Rhigopsidius tucumanus, 1380
Solenopsis saevissima, 1381
Trypopremnon spp., 1380
photoperiodism, 226, 792*, 1389, 1874
plant population, 1483
pollen fertility, 261
radiation, global, and yield, 778
rainfall, effect of, 1848, 1866
and soil-clay type, 801
on second-growth, 781
root growth, 1864, 1869
rotations, 236, 575, 789, 1406, 1641, 1848, 2038, 2040
seed (true), dormancy-breaking, 1856*
seed potatoes
chitting, 242, 257, 1362, 1843, 1855, 1865, 1867, 1887 — see also sprout induction below
classification schemes, 245
dormancy, 259
breaking, 242, 258, 1861* — see also sprout induction below
fumigants, effect of, 1855
fungicides, effect of, 1855
germination, 1387
grade, effect of, 1361
growth-inhibiting substances in, 259
growth substances, effect of, 1384
once-grown v. certified, 775
planting date, 228, 286, 777, 1363, 1392, 1840, 1866
planting depth and *Rhizoctonia solani*, 1376
planting method, 773
production, 14, 243, 244, 775, 1841, 1843, 1865, 1871, 1874
and harvesting date, 777, 790
seed rate, 228, 1360
sett(s)
cut
periderm formation, 1862
treatment of, 254, 777, 1858, 1862
v. whole, 1841
cutting date and yield, 1842
size, 228, 232, 515, 775, 777, 789, 1360, 1362, 1841
spacing, 231, 232, 302, 515, 775, 777, 789, 1360, 1840, 1841
sprout
development, 1387
induction, 267, 793, 1385 — see also chitting above
inhibition, 1888
sprouting, 259, 260, 1868
and haulm destruction, 1384
and soil moisture, 1870
and tuber reserves, 1387
methods compared, 784
storage, 244, 258, 259, 260, 282, 780, 781, 806, 1867, 1871, 1874, 1887, 1888
temperature during tuber formation, effect of, 262
treatment, 253, 254, 258, 267, 515, 789, 1376, 1385, 1855, 1858, 1888, 2058—see also sprout

induction, chitting and under sett(s) above
vernalization, 1868
weight, and yield, 1360
wounding, and yield, 258
shoots, number of, and earliness, 1865
soil
aeration, effect of, 264
condition, effect of, 1884*
disinfection and scab control, 789
moisture
effect of, 233, 234, 235, 774, 778, 1845, 1848, 1870, 1879
requirements, 226, 1846
pH and scab control, 789
temperature, and yield, 778
type, and seed production, 243
sprout
induction, 284 — see also seed potatoes above
inhibition, 281, 282, 283, 284, 286, 1385, 1387, 1401, 1872, 1873, 1878, 1880
by irradiation, 1405, 1878, 1889*
sprouting, 260, 1383, 1866
and temperature, 1869
and tuber reserves, 1387
straw, ploughed-in, effect of, 2038
temperature — see also soil temperature above
effect of, 1866, 1869, 1874, 1879
heat resistance, varieties, 1879
requirements, 226
tuber(s)
aerial, formation, 1863*
' blackening', 274*, 789, 796, 1395, 1494, 1877, 1878
chemical composition, 1392, 1402
amino-acid content, 797, 798
and ' blackening', 789, 796, 1395
and irradiation, 1405
and storage temp., 1886
chlorophyll formation, 266
protein content, 797, 798
solanine determination, 273*
starch, 271, 272
and fertilizers, 1884*
damage, 780, 805*, 1395, 1890
dry-matter content and NPK, 1876
eyes, number of, 1865
formation, 1392, 1865
and growth substances, 268, 1860
and seed-tuber storage, 1867
and soil aeration, 264
and soil moisture, 233, 1847*
and temperature, 262
varietal differences, 1867
' glassy', 781
greening, 275
irradiation, effect of, 266, 275, 1405 1878, 1889*
light intensity, effect of, 275
number and growth substances, 1860
penetration of IPC into, 1880
production and temperature, 1874, 1879
quality — see also ' blackening ' above
and herbicides, 247
and soil moisture, 1848
control, in France, 1891
cooking, 274*, 1397, 1876, 1877
and fertilizers, 800
and MH, 1873
and storage, 285
flavour, 255, 275, 285, 1379, 1396, 1874
keeping-, and fertilizers, 1399
testing for, 1893
reserves and sprouting, 1387
respiration and growth substances, 1859
ripening and leaf nutrition, 1702
separation by using brine, 1398
size
and fertilizers, 232
and seed-tuber size, 1362
and spacing, 232
sorting, 773
specific gravity, 1397, 1398, 1399, 1873, 1875
storage, 247, 256, 260, 275, 279, 280, 281, 282, 283, 284, 285, 286, 515, 773, 780, 781, 800, 806, 1069, 1363, 1383, 1387, 1395, 1400, 1401, 1402, 1403, 1404, 1405, 1873, 1878, 1886, 1889* — see also seed potatoes above
tissue, ion leakage and growth substances, 1859
water uptake and growth substances, 1859
wound healing, 1400, 1390*
utilization of, 1640*
varieties, 226, 240, 261, 271, 515, 773, 1364, 1365
aberrant types, 1374
in Algeria, 230
in Colombia, 228
in France, 1891
in Germany, W., 1850
in Italy, 783, 1365
in Kenya, 1373
in Mexico, 1370
in Norway, 237
in Spain, 782
specific
A-41....239
Ackersegen....257, 394, 783, 1850, 1865
Adina....231
Agnes....239
Alava....239, 1851
Alegría Oro....239
Alpha....1395
Alpha A....241
Alpha B....241
Alzania....239
Arana 41....1851
Arana 56....1851
Ari....1851
Arran Banner....239, 1851
Arran Pilot....237
Así....239
Augusta....1865
Awaba....231
Baguio....241
Benedikta....783, 1865
Bevelander....781, 1887
Bintje....238, 239, 257, 781, 783, 1395, 1398, 1851, 1865, 1891
Bona....780, 783, 1850, 1865
Buena Vista....1372
Cherokee....275
Chippewa....1369
Choriza....782
Craigs Royal....239
Dakota Red....1369
Doon Early....237
Duke of York....237
Dukker grønne groer....237
Dunvegan....237
Dutch Robijn....1373
Early Puritan....237
Eersteling....1865
Eigenheimer....238, 259, 781, 793, 1395, 1398
Electre....238
Epicure....237
Eréndira....1370
Erntedank....239
Eva....237
Frühbote....237
Frühmölle....237
Furore....1395
Gauna Blanca....239
Gineke....793, 1363
Goya....239, 1851
Green Mountain....254, 1886
Heida....239, 1850
Huron....1366
Immertreu....239
Immun Kaiserkrone....237
Irish Cobbler....237, 1886
Japan No. 5....241
Japan No. 6....241
Kalitinec....229
Katahdin....239, 262, 275, 278, 286, 785, 1369, 1886
Kennebec....275, 783
King George V....237
Krasawa....239
Libertas....1887
Lorh....229
Magnum Bonum....259
Majestic....259, 783, 794
Maritta....783, 1850
Meerlander....1887
Monserrate....1371
Netted Gem....1886
Noordeling....1395, 1887
Nordak....1367
Norgleam....1367
Norland....1368
Nova....783
No. 50-57-63....777
No. 50-57-67....777
Ojona....1371
Olalla....239, 1851
Ontario....274*
Palogán....239, 1851
Panther....783
Primula....237
Professor Broekema....1373
Profijt....1373
Record....1395
Red McClure....270
Red Pontiac....774
Russet....285
Russet Burbank....1875
Sabina....239
Saga....237
San Michele....783
Santa Lucía....239
Santa Rafaela....1372
Saskia....783
Sebago....234, 774, 1369, 1886
Sergen....239
Sirtema....783, 1865

Solanum....239, 783, 1851
Tammisto Early....237
Tocana....1371
Tocana Blanca....777
Tonda di Berlino....783, 794
Tuquerreña....777, 1371
Vanguard....237
Vera....783
Voran....238, 1373, 1395, 1851, 1865
Walanga....231
Wiga....1851
water use, 233
and root growth, 1864
water uptake, and abnormalities, 263*
weather, effect of, 1866
weeds in, 228, 246, 248, 249, 785, 786, 1552, 1553, 2014
Agropyron repens, 394
Cyperus esculentus, 395
Galinsoga parviflora, 250
Potatoes, wild — see *Solanum* spp.
Premnotrypes solani, 1380
Principe Is, climate, soils and veget. map, 2021
Prodenia litura, 1428
Prunus spp., 215
Psallus seriatus, 1427
Pseudoberlinia sp.—see under Weeds
Pseudococcus maritimus, 1381
Psophocarpus tetragonolobus, 1631
Pteridium sp. — see under Weeds
Puccinia spp., 1690
Pyp grass — see *Ehrharta villosa*
Pyrausta nubilalis, 76, 1207
Pyrenophora avenae, 1690
Pythium debaryanum, 311
Quackgrass — see Weeds, *Agropyron repens*
Quinoa (*Chenopodium quinoa*), grain, chem. comp., 1272
Radioactive fallout, absorption by plant, 390, 902
Radioactive waste, uptake by plant, 389, 903, 1988
Radioisotopes, 355, 386*, 528, 899, 900, 901, 1058*, 1980*
accumulation
in plants, 389, 390, 391*, 902, 903, 904, 1988, 1990 — see also uptake below
in soil, 389, 902
and agricultural research, 1523
and osmosis studies, 1473
determination, quantitative, 1979
handling of, 388*
research, use of interval-timer in, 897
specific
barium, 1979
caesium, 903, 1979
calcium, 902, 1991
carbon, 102, 172, 528, 917*, 1157, 1992
carbon dioxide, 1470
cerium, 1990
chlorine, 357
cobalt, 904
phosphorus, 70, 392, 1144, 1161, 1393, 1715*, 1991
radium, 1521
rubidium, 1991
sodium, 387
strontium, 390, 391*, 902, 903, 1979, 1988, 1990
uptake in plant, 389, 390, 391, 392, 903, 1988
Rape (*Brassica* spp.)
B. campestris var. *oleifera* subvar. *annua*
harvesting, 869
harvesting date, 869
oil, chem. comp. and harvesting date, 869
shedding, 869
varieties, 1460
B. campestris var. *oleifera* subvar. *biennis*
harvesting, 869
oil, chem. comp. and harvesting date, 869
rotations, 960
seed rate, 867
sowing date, 867, 1459
sowing method and winterhardiness, 1459
spacing, 867, 1459
winterhardiness, 1459
varieties, 867
B. napus
as catch crop, 2041
growth and wind speed, 1484
identification, 1993
insecticides, effect of, 348
pests, *Rhopalosiphum pseudobrassicae*, 348
wind speed and growth, 1484
B. napus var. *oleifera*, vicinism, 868*
B. napus var. *oleifera* subvar. *annua*
frost resistance, 347
harvesting, 347
in W. Canada, 347
rotations, 960
varieties, 347
B. napus var. *oleifera* subvar. *biennis*
chemical composition, 1461
harvesting date, 869
seed, chemical composition, 1461
seed rate, 867
shedding, 869
sowing date, 867, 1459
sowing method and winterhardiness, 1459
spacing, 867, 1459
winterhardiness, 1459
varieties, 867
general
dry-matter determination, sampling technique, 893
herbicides, monoxone, effect of, 764
insecticides and crop quality, 1610
rotations, 969
S deficiency, 883
soil moisture, effect of, 1948*
weeds in, 764
Raphanus raphanistrum — see under Weeds
R. sativus oleiferus, for fodder, in Germany, 2042
Red-winged blackbird — see *Agelaius phoeniceus*
Rhigopsidius tucumanus, 1380
Rhizobium japonicum, 722
Rh. lupini, 1997
Rhizobium symbiosis — see nodulation under Legumes and individual crops
Rhizoctonia sp., 788, 1855
Rh. solani, 253, 311, 1366, 1376, 1425
Rhizopertha dominica, 651
Rhizophora racemosa — see under Weeds
Rhodesia, Northern
farming systems, 962, 2022*
maize, 962
Rhopalosiphum pseudobrassicae, 348
Rhus radicans — see under Weeds
Rice (*Oryza* spp.)
branching, aerial, 688
chemical composition, 135, 692
and salt injury, 1266
combine-harvesting — see harvesting below
cropping, double-, 1764, 1765, 1766*
culm — see stem below
cultivation
and root growth, 1251
and soil conservation, 1596
' cage-wheels', 696
hillside, 1596
' Japanese ' method, 110, 144, 663
on saline soil, 1575
' palagad', 112
ploughing, deep, 1224
ridging, 109
wet, 1224
detillering, effect of, 688
diseases, 664, 673
akagare, 1239
akiochi, 693
Helminthosporium oryzae, 126
Leptosphaeria salvinii, 1237
Piricularia oryzae, 120, 126
root rot, 685
seed-borne, 2057
straighthead, 1240
Ustilaginoidea virens, 1759
white leaf ('hoja blanca'), 677, 678, 679
drought resistance, upland v. lowland vars, 1781*
dry-matter production, 1260*
drying, 114, 143
earing
and light intensity, 1259
and NAA, 130
nutrient translocation during, 129
FAO projects, 698
Fe deficiency, 1772
fertilizers, 110, 118, 132, 133, 136, 137, 138, 139, 140, 144, 494, 691, 695, 699, 1243, 1260*, 1263, 1268, 1772, 1778, 1784, 1785*, 1786 (2)(3), 1798
and ratooning, 666, 1765
field(s)
drainage — see soil drainage below
phytosociology, 421
water temperature in, 113
flowering
and photoperiod, 131
and seed treatment, 699
second-, 1764
fungicides, effect of, 1786(2)
grain(s)
chemical composition, 692, 1268
moisture content, 1269
number of, factors affecting, 1258, 1259, 1775
processing, 143
quality
and harvesting date, 1226

and soil fertility, 1785*
milling, and storage, 142
ripening, 1263, 1783*
suncracking determination, 694
white-cored, 1268
green manures, effect of, 978
growth, 134, 1248, 1257*
and night temperature, 1775,1783*
and seedling qualities, 1246*
and soil drainage, 686
growth substances, effect of,
bean-seed extract, 1777*
IAA, 130
NAA, 130
sulphanilamide, 1242
harvesting
and ratooning, 1765
combine-, 697
harvesting date, 109, 112, 1226
and ratooning, 666, 1765
heading, time to, 1257*, 1258
and salt injury, 1266
herbicides, effect of, 665
CIPC, 1771
MCPB, 1236
2,4-D, 1236
2,4,5-TP, 125
in Afghanistan, 659, 660*
in Algeria, Oran, 1223
in Brazil, 111, 1271*, 1761*
in Ceylon, seed prod. and distribution, 1762
in Colombia, 661*
in Cuba, 1760*
in France, Camargue, 1229
in French Oceania, 1576
in Fr. W. Africa, 1758, 1759
in Gambia, acreage, 1078
in India, S. Kanara, 110
in Indonesia, 699
in Iran, Baluchistan, 1227*
in Italy, 697, 1228
in Malaya, 700*, 1786(1)
in Neth. New Guinea, 117
in Paraguay, 143
in Philippines, 112, 123
in Sarawak, 518
in Spain, yields, 1228
in USA, Texas, 664
insecticides, effect of
metaisosystox, 679
metasystox, 679
intercropping, and soil and water conservation, 1597
interplanting, in rubber, 115
irrigation, 109, 111, 662, 1224
-water
circulation, 686
depth, effect of, 1763
temperature, 113, 1255, R.A. p. 90
latitude and photoperiodism, varietal response, 1256
leaf
analysis, 135, 1778
chemical composition
NPK, 1778
sugar content, 1264*
Zn, 1970
number
and photoperiod, 1258
and tiller removal, 1258
nutrition, 1239
' topping', 109
vascular bundles, no. of, and rooting, 1249*
light intensity, effect of, 1258, 1259, 1262, 1268, R.A. p. 87
lodging, 109, 691
lowland, 112, 684, 1758, 1778, 1781*
mill, 1787*
milling percentage and moisture content, 1269
Na, exchangeable, tolerance to, 1798
nutrient translocation, 1263, 1265, 1778
nutrient uptake, 134, 1780*
nutrition, 690*, 1253, 1261*, 1262, 1265, 1778, 1779*, R.A. p. 90
on saline soil, 1223, 1575, 1578 — see also salt injury below
Oryza brachyantha, 681
O. glaberrima, 1782
O. grandiglumis, 681
O. malampuzhaensis, 1773
O. perennis var. *balunga*, 680
O. sativa, 129, 134, 1782
O. sativa var. *bulu* × *indica*, 699
O. sativa var. *fatua*, 680
O. sativa var. *indica*, 132, 1764
O. sativa var. *japonica*, 132, 1774*
on organic soils, 116
on peat, 1786(3)
panicle(s)
growth, 689
number per sq. m., 1759
pests, 664, 673
Atherigona spp., 674
Chironomus thummi, 1238
Cnaphalocrocis medinalis, 675
crab, 676
Cricotopus trifasciatus, 1238
leafhoppers, 678, 679
Leucania unipuncta, 127
photoperiodism, 130, 131, 689, 1256, 1257*, 1258, 1261*, 1782, R.A. p. 85
photosynthesis, 1260*, R.A. p. 90
plant population, 1260*
planting date, 112
pollen-tube, protoplasmic streaming in, 1254
pollination, 153, 1262
rainfall, effect of, 479
ratooning, 666, 1765
red — see under weeds below
respiration, R.A. p. 90
root(s)
arrangement and leaf vascular bundles, 1249*
chemical composition, 1252, 1253
extract, oxidation by, 685
formation and soil type, 1251
growth, 686, 1248, 1251
H_2S oxidation, varietal differences, 693
lacunas, cortical, 1250*
oxidation, and night temp., 1775
sampling technique, 1248
viability determination, 1252
rotations, 109, 304, 659, 969, 1223, 1225, 1424, 1766*
and weed control, 670
S deficiency, 1779*
salt injury, 1266 — see also on saline soil above
seed — see also sowing method below
certification, 669
germination, 1243, 1786(2), 1943
testing, 377, 1241
irradiation, effect of, 699
light, effect of, on flowering, 699
seed-bed preparation, 112, 1224, 1244, 1245
seed production, 14, 669, 688, 699, 1762
seed storage, 1232, 1786(2)
seed treatment, 128, 130, 682, 1084, 1242, 1244, 1786(2)
seedling(s)
chemical composition
and temperature, 1245
carbohydrate content and root growth, 683
drought resistance, 684
enzyme, adaptive formation of, 687
fertilizers, effect of, 1244
growth, 1243, 1245
and seed-bed nutrition, 1244
nutrient uptake and temperature, 1245
nutrition, 687
qualities, and subsequent growth, 1246*
root growth, 683, 684, 1244, 1776
soil temperature, effect of, 683
temperature, effect of, 1245
tillering, 1247*
transplanting, 109, 112, 144, 665, 696, 1244, 1245, R.A. p. 90
shoot, chemical composition, 1253
soil conditioners, and yield, 141*
soil drainage, 686, 1224, 1229
soil moisture, eflect of, 1243, 1786(4)
soil type, effect of, 1248, 1267, 1785*
sowing date, 111, 1222, 1226, R.A. p. 88
sowing method, 109, 1224, 1243
aerial reseeding, 1084
broadcasting v. drilling, 697
spacing, 109
spikelet formation, variation in, 681
stem
dynamical characteristics and lodging, 691
number and night temp., 1775
sugar content, 1264*
sterility, 690*, 699, 1255
storage, 142, 143
temperature, effect of, 1245, 1257*, 1263, 1775, 1783*, R.A. p. 89
threshing, 114
tiller removal, effect of, 1258
tillering
and light intensity, 1259
and photoperiod, 130
and seedling qualities, 1246*
transplanting — see under seedling(s) above
upland, 684, 699, 1244, 1759, 1781*
v. lowland, at low temperatures, 1245
varieties, 110, 112, 680, 693, 1255, 1258, 1259, 1758, 1775
in Brazil, 111, 1271*
in India, Punjab, 668
in India, U.P., 109, 121
in Indonesia, 699
in Italy, 119, 667

in Morocco, 118
in Philippines, 120
in USA, Texas, 664
specific
Acheh Puteh....1786(5)
Agulha....662
Americano 1600....1767, 1768
Apostol....120
Arborio....1767, 1768
Arborio tipo....131
Azucena....125
B49-5849....131
B52-3557....131
Balilla × Benlloch....1767
Balilla Double....1767
Balilla Large Grain....667, 1072, 1768
Balocco....667
B.A.M.....131
Baraggia....667
Batatais — see ' 3 months' below
Bengawan....120, 131
Blue rose....131, 662
Bolibol....131
BR × BR-R (6-1-21-12)....131
Brondol Putih T-43....120
Century Patna 231....1765
Ch. 45....668
Ch. 47....668
Ch. 972....668
Ch. 988....668
Chialungyu No. 242....122
Chianan No. 3....122
Chiang An Chih Kei Cheih Lan 131
Chiusei Asahi....118
C.I. 7266 Rec. B....131
Co. 4 × ADT 10....131
Co. 13....684
Colosso....667
Colusa 1600....118
Colusa × Nano....1767
Dima....1226
Dundar 43....668
E 12....1248
E 411....1248
Early Corbetta....667
(E.P.B.R.)^{3} × 7.9054 rogue.... 131
family 19....144
family 21....144
family 79....144
family 115....144
Ferraris....667
Fi Ho Ju....131
Fortuna....662
Fortuna negro....131
Guaíba....1222
Hill med. × Zenith Bnt. 54.... 131
Imperial blue rose selection.... 131
Indica group....1759
Indo-Japonica group....1759
In-oban....131
Insen × Tremesino....1767
Intan....120, 131
Japonesito de tres mes....119
Japonica group....1759
Kinastila....131
Lacrosse....677
Lal Nakanda 41....668
Lao Lai Ching....1781*
Lomello....667, 1768
Macan 1....131
Malagkit senador....131
Malaman 350....120
Maracay....1767
Mas....1232
Milfor 6 (2)....142
Mitao....131
MTU. 17....684
Murungakayan....1232
N 136....130, 682
Nachin 5057....1786(5)
Nang Ton Xao....1781*
Nickerie....1226
Norin....118
Nori mochi no. 5 L44....131
No. 6-1-21-12....131
No. 301....1222
No. 302....1222
No. 303....1222
No. 401....1222
No. 402....1222
No. 403....1222
Olcenengo....667
Olmo....1230
Paradijs....1226
Peta....120
P.I. 7217....131
P.I. 8920a....131
P.I. 160650....131
P.I. 160902....131
Pin chuan B....131
P.R. 358....131
P.R. 388....131
Prelude....131
Prolific....662
P.T. selection (B52-3557).... 131
Puebla Larga....1767
R 55....1248
R.B.....131, 1768
Radin Siak 34....1786(5)
Razza 77....1767, 1769
Remedja....131
Rexoro selection (B49-5849).... 131
Reyong 6....1786(5)
Rikuto sanin no. 25....131
Rinaldo Bersani....118, 1767
Rizzotto....1768
Rizzoto tipo....131
Roverbella....667, 1768
S415 A16-5-1-3....131
S. Domenico....667
S. Giacomo....667
Salak....120
Serendah Kuning 3....1786(5)
Serendah Kuning 11....1786(5)
Serendah Kuning 23....1786(5)
Shinchiku-iku no. 161....131
Shinchiku mochi iku no. 43.... 131
Shinzu....118
Shui Pe Tiao....666
Siam 29....1786(5)
Sinoltero....131
Sinto norim no. 29....131
SML 80/3/1/5/5....1226
SML 80/3/1/6/7....1226
Solo....131
Sordo....1767
Stirpe 82 Chiappelli....1768
Stirpe 136....1767
T. 36....121
T. 139....121
Taichung no. 65....122
Taihoku iku no. 111....131
Taihoku no. 111.....131
Tainan-iku no. 490....131
Taishomochi....131
Thailand....131
'3 months'....1770
Tjahaja....120
Tjina....120, 134
Trionfo Fassone....1231
Zenith....131
Zenith × Nira (S415 A16-5-1-3) 131
vernalization, 689, R.A. p. 90
water relations, upland v. lowland vars, 1781
water use, 134
weeds in, 112, 125, 664, 670, 673, 697, 937, 1233*, 1234, 1236, 1251, 1552
algae, 124
Alisma sp., 670
Chara spp., 670
Cyperus sp., 670, 1786(4)
Echinochloa crus-galli, 1771
Eleocharis plantaginea, 1234
Fimbristylis miliacea, 1786(4)
Monochoria vaginalis, 1786(4)
Panicum crus-galli, 670
P. crus-galli var. *hostii*, 670
Phragmites communis, 670
Polygonum persicaria, 670
red rice, 1224, 1235
Scirpus sp., 670
Sesbania punicea, 929
Typha spp., 670
wild rice, 672*
yield estimation, 1270*
Rodent control, 1019
Rooks, seed protection against, 2059
Root crops (general), 1056 — see also individual crops
storage, 819
Root-knot nematodes — see *Meloidogyne incognita*
Roselle (*Hibiscus sabdariffa*)
diseases, *Macrophoma urenae*, 1450
fertilizers, 856
v. jute, 1450
yield trials, 856
Rosellinia sp., 1378
Rotations, 960, 1056, 2086 — see also Cereals, Legumes and individual crops
and evapotranspiration, 991
and herbicides, 2011
and soil organic-matter content, 2039
in Greece, and N deficiency, 2043
in S. Africa, 452
in Uganda, 1907
Ruanda-Urundi
climate, 998*
flora, 526*, 1053
hail storms in, 2052*
land use, 1571
soils, 1571
sorghum, 104
Rumex sp. — see under Weeds
Russian knapweed — see Weeds, *Centaurea repens*
Rye (*Secale cereale*)
for fodder
as silage, 1275
clipping, effect of, 1789

cropping, mixed, 2041
fertilizers, 1789
harvesting date, 1275, 2041
photoperiodism, 602
varieties, 2041
vernalization, 602
for grain
clipping, effect of, 1789
drying, 161
ear(s)
number of, and fertilizers, 715
sprouting in, varietal susceptibility, 1704
fertilizers, 39, 52, 577, 715, 1149, 1789
flowering
and heat damage, 1284
and light wavelength, 154
and photoperiod, 154
frost, effect of, 702
grain
gluten content, 577
number, 715, 1149, 1284
1000-grain weight, 351, 702, 1149
weight and fertilizers, 715
growth and seed size, 702
growth substances, MH, effect of, 872
harvesting date, 702
herbicides, effect of,
DNC, 1285
simazin, 1730
irrigation, 1586
light wavelength and flowering, 154
photoperiodism, 51, 154, 602, 1286
plant population, 1149
pollination, 153
rotations, 53
seed treatment, 600
seedling, auxin content, 51
sowing date, 53, 1090
temperature, effect of, 1284, 1286
vernalization, 602
and auxin content, 51
weather and yield, 1149
yield factors, 1149
general
× wheat (*Triticale*), winterhardiness, 1676
as cover crop, on saline soil, 467
as green manure, 1647
auxin content, 51
climate, effect of, 1705*
cold resistance and DNC, 1285
cultivation, 1047
diseases, 1016, 1047, 2057
fertilizers, 468, 715, 1047
flowering and auxin content, 51
growth and photoperiod, 23
in Gt Britain, 1047
nomenclature, in Africa, 151
on saline soil, 467
on sandy soil, 468
pests, 1047
Ditylenchus dipsaci, 1148
photoperiodism, 23
root, cold resistance, 1676
seed
dormancy breaking, 706
size, effect of, 702, 1090
viability, duration of, 351
seed production and harvesting date, 702
seedling(s)
benzoxazolinone formation in, 601*
irradiation, effect of, 1992
protein synthesis and irradiation, 1992
root growth and auxin content, 51
sowing method, 1047
growth and auxin content, 51
temperature requirements, 1705*
varieties, 482
in Argentina, 50*
in Belgium, 1285
in Gt Britain, 1047
in USA, N. Carolina, 1792
specific
Bernburger....2041
Borris Perle....49
Borris Perle elite 2/50....49
Ensi....1704
Heertvelder....1148
Kungs II....1704
No. 01075....1704
Petkus....49, 51, 1148, 2041
Petkus Grünschnittroggen....2041
Petkus Zuchtgartengemisch..49
Sejet Kærne....49
Svalöf Kongs II elite 46....49
Svalöf Kongs II elite 48....49
Svälog Kongs II elite 50....49
Toivo....1704
Visa....1704
Vjatka....1704
weeds in, 394, 936
winterhardiness, 1676
Ryegrass — see *Lolium* spp.
Saccharomyces sp., 1997
S. cerevisiae, and retting-water, 853
Saccharum spontaneum — see under Weeds
Safflower (*Carthamus tinctorius*)
in Australia, 1456
in Cyprus, 864
in Spain, 1455
seed rate, 343
spacing, 343
var. 1-52-260....343
Saffron thistle — see Weeds, *Carthamus lanatus*
Salsola kali — see under Weeds
Samoa, Western, farming systems, 2023*
Sand stabilization — see under Soil and water conservation
Sanseviera spp. — see under Weeds
São Tomé Is, climate, soils and veget., map, 2021
Sarawak, agriculture, 518
Sardinia, land reclamation, 436
Sarson (*Brassica campestris*)
insecticides, effect of, 348
pests, *Rhopalosiphum pseudobrassicae*, 348
Saudi Arabia, land use, 431
Scirpus sp. — see under Weeds
Scolymus hispanicus — see under Weeds
Secale cereale — see Rye
Seed(s) — see also under Cereals, Weeds and individual crops
-counter, semi-automatic, 1502
excretion by birds and viability, 2008
germination — see also **Seed testing**
and soil salinity, 1942
stimulation, 1944
imbibed, respiration of, 1471
viability, 351
after excretion by birds, 2008
Seed-bed preparation, 483 — see also individual crops
Seed certification
in OEEC countries, 1605
rice, 669
Seed exchange
in Australia, 1083
in Belgium, 1068
in Italy, 1639
Seed production, 522 — see also individual crops
in India, 536
Seed rate — see also individual crops
and soil and water conservation, 2046
Seed storage
barley, 580, 1168, 1288
cotton, 830, 2064
fibre flax, 1927
lupins, 198
maize, 653, 1288, 1746
oats, 44, 1145, 1288
potatoes, 244, 259, 260, 781, 806, 1867, 1871, 1874, 1887, 1888
rice, 1232, 1786(2)
sorghum, 1288
sunflower, 2064
wheat, 15, 40, 1131, 1132, 1288, 1665
Seed testing, 522, 891 — see also Cereals and individual crops
methods
East Craigs, 376
germination in sand, 1793
paper-roll, 1793
tetrazolium, 1793
Ulster, 376
Wageningen filter paper, 376
Seed treatment, 358, 489*, 1049, 2059 — see also individual crops
and frost resistance, 359
protection against rooks, 2059
Seed weevil — see *Ceuthorhynchus assimilis*
Seeds Acts, Gt Britain, 501
Serradella (*Ornithopus sativa*), in S. Africa, 1327
Serrated tussock — see Weeds, *Nassella trichotoma*
Sesame (*Sesamum indicum*), 860
capsule dehiscence, 1453
flowering and GA, 339
growth substances, GA, effect of, 339, 1452, 1932
harvesting, 350
in Ethiopia, highlands, 657
in Kenya, 350
rotations, 1579
seed, oligosaccharides in, 1931
seed rate, 350
seed treatment, 1452
spacing, 350
Sesamia spp., 86, 437
Sesamum indicum — see Sesame
Sesbania aegyptiaca, as green manure, 978
S. punicea — see under Weeds
S. speciosa, as green manure, 978
Setaria spp. — see under Millets and Weeds
S. italica — see under Millets and Weeds

S. italica var. *purpurea* — see under Millets
S. lutescens — see under Weeds
S. viridis — see also under Weeds
v. *Sorghum sudanense*, comp. yields, in USSR, 701
var. Bučanskaja....701
Shabdar — see Clover, *Trifolium resupinatum*
Sheep's sorrel — see Weeds, *Rumex acetosella*
Shelterbelts — see Windbreaks
Shifting cultivation, 517, 518, 520, 2045
Sicily, sugar-beet, 1073
Sinapis alba — see under Mustard
S. arvensis — see under Weeds
Sitona sp., 192
Smartweed — see Weeds, *Polygonum* spp.
Soil(s) — see also individual crops
aeration, and plant requirement, 354
analysis, 384
B, 1649*
Mo, 383*
V, 383*
W, 383*
Ca content
and plant Ca uptake, 1989*
and plant Sr uptake, 1492, 1989*
and plant ^{90}Sr uptake, 1988
calcareous, and effect of added straw on plant nutrition, 1492
clay, pelophytes as indicators of, 1526
/climate complex, in France, 2065
colloidal substances in, and root growth, 1974
-colour and -temperature, 1170
condition and water availability, 1479
earthworms, effect of, 1018, 2066
formation, plant factor in, 2068*
frost-heaving, measurement, 1603*
fumigation, 1606
in Africa, map, 1634
in Belgian Congo, 1571
in Ghana, 963
in Ruandi-Urundi, 1571
in São Tomé and Príncipe Is, map, 2021
marshland, 435, 484
organic-matter content and cropping, 2039
peat
nodule-inhibiting substance in, 1819
reclamation, 434, 1004
pH, low, and crops, 881*
/plant relations, 527
quality, plant indicators of, in Brazil, 1612*
radioisotope accumulation in, 389, 902
rain-drops, effect of, 1587
respiration studies, 1972
saline, 437, 438, 467, 956, 1575
and seed germination, 1942
sandy, 436, 468, 469
psammophytes as indicators of, 1526
Sr and plant nutrient uptake, 1492, 1989*
structure, and duration of arable cropping, 2040
studies and radioisotopes, 528
survey, Anglesey, 950
temperature
and evaporation, 1587
and windbreaks, 447*
measurement, 385*
texture and growing season, 1603*
/water relations, 2087*
water storage capacity and cropping, 2040
Soil conditioners, 141*
Soil erosion — see under Soil and water conservation
Soil fertility
and duration of arable cropping, 2040
in Ghana, 963
Soil moisture, 879
and crop rotation, 975
and plant growth, 877, 1479, R.A. p. 1
determination, 1093, 1517, 1844, R.A. p. 5
Soil sterilants, 1049, 1854
Soil and water conservation, 1590
contour strip farming, 1907
in Africa, 2086
in Ceylon, 1592*
in E. Africa, 457
in tropics, 2086
soil drainage
in USSR, 444
terraces, in Italy, 462
soil erosion, 2085, 2086
and percolation rate, 470
control, 2085
cropping for, 457, 465, 1596, 1597, 2046, 2086
fallowing method for, 546
gullies, 464
in India, Kerala State, 1591
in S. Africa, 452
on saline soils, 467
vegetation for, 1599, 2086 — see also cropping for, above and sand stabilization below
in Australia
Hume catchment area, 466*, 1598
mountain catchments, 983
in Ceylon, and weed control, 1554
in India, Punjab, 1577
in Japan, 465
in Pakistan, Punjab, 1577
sand stabilization, plants for, 468, 469, 982, 2086
terracing
bench, 2047
and drainage, 462
contour bunding, 1594
with stone walls, Italy, 462
water conservation, 461
by clean cultivation of land, 1595
cropping systems, 457, 465
dam construction, 985, 2086
hill-side dykes, in Italy, 462
in USSR, 1593
reservoirs, for irrigation, Italy, 2033
underground, in E. England, 460
water extraction from saturated sand, 984
water loss from bare soil, 844
water run-off, 470, 1597
control, vegetal cover for, 2046
water percolation rate and runoff, 470
watershed management, Far East, 459
Solanum spp. — see also Potatoes
nomenclature, in Argentina, 1881*
S. demissum, 1852
S. rostratum — see under Weeds
S. tuberosum — see Potatoes
Solar radiation — see under Irradiation
Soldier thistle — see Weeds, *Picnomon acarna*
Solenopsis saevissima, 1381
Somaliland, land reclamation, 957
Sonchus arvensis — see also under Weeds
germination, 916, 918
Sorghums (*Sorghum* spp.) — see also Broom corn, Millets and Weeds
general
cultivation, bench terraces, 2047
for fodder, as silage, 2047
grain, amino-acid content, 1217*
varieties, in Mexico, 1213*
S. dochna, for fodder, in Germany, 2042
S. sudanense, 936, 2042
S. vulgare
bird repellents and germination, 1753
cells, parenchymatous, structure of, 352
cropping, mixed, 1210, 1751
cultivation, 1080
inter-row, 483
ploughing depth, 483, 966, 1534
diseases
seed-borne, 2057
Sphacelotheca sorghi, 104
drought, effect of, 635
Fe deficiency, 1754
fertilizers, 100, 106, 494, 848, 976, 1080, 1210
for forage, 106, 1214, 1225
as silage, 1210, 1275, 1606, 1751
glume colour, classification of, in Nigerian vars, 1216*
grain, moisture content and storage, 1218
harvesting date, 657, 1209, 1275
herbicides, dinoseb, effect of, 1562
in Australia, 724, 1210
in Ethiopia, 657
in India, 1080
in Ruanda-Urundi, 104
in USSR, seed production, 1440
interplanting, 657, 1584
irrigation, 105, 1080, 1209, 1750
leaf stomata, effect of drought on, 635
nematocides, effect of, 1606
on sandy soil, in Italy, 1209
pests, 1080
Agelaius phoeniceus, 1753
Calandra oryzae, 658
Cassidix mexicanus major, 1753
Contarinia sorghicola, 108, 1215
Longiunguis sacchari, 1215
nematodes, 1606
Passer domesticus, 1753
Rhopalosiphum maidis, 1215
photoperiodism, 724
plant population, 1209, 1483
rainfall, effect of, 479
root development, 1750
rotations, 657, 966, 1210, 1225
and water conservation, 457
seed
and bird repellents, 1753

fumigants, methyl bromide, effect of, 1288
germination testing, 1755
viability, duration of, 351
seed-bed preparation, 105, 1211
seed protection, in USSR, 1440
seed rate, 105, 483
seed storage, 1288
seed treatment, 104, 108, 1080, 1288
seedling emergence, 1208
soil fumigation, effect of, 1606
soil moisture, effect of, 1750
sowing date, 483, 657, 1080, 1209, 1214
spacing, 105, 106, 483, 657, 1210, 1211
stem moisture stress and electrical resistance, 379
storage, 658, 1218
temperature and emergence, 1208
varieties, 482, 1080, 1209, 1210
drought-resistant, 1752
in Ruanda-Urundi, 104
specific
Alpha....105
Caprock....105
Early Hegari (Hegari Precoz)....1214, 2047
Hegari....483
Hybrid 610....2047
Kafir 1....1214
Kalo....483
Martin....105
Redbine 66....105
S-1....1752
Waxy Combine Kafir....105
Wheatland....105
weeds in, 937, 1080
S. vulgare var.
green manures, effect of, 598
rotations, 598
S. vulgare var. *saccharatum*
for forage, 1121
for syrup, 107
varieties, 107, 1211, 1214
Sorghum halepense—see also under Weeds
Soursob — see Weeds, *Oxalis pes-caprae*
South Africa, Union of
groundnuts, 1305
maize
costs, 654*
varietal trials, 1728
rotations, 452
serradella, 1327
soil conservation, 452
Southern armyworm — see *Persectania ewingii*
Sowthistle — see Weeds, *Sonchus arvensis*
Soyabeans (*Glycine max* [*G. hispida, G. soya*]), 1631
cells, parenchymatous, structure of, 352
chemical composition, Fe, 1303
cross-inoculation group, 749
cultivation, rotovating and weed control, 1292
defoliation, effect of, 1804
diseases, 1016
chlorosis, and root cation-exch. capacity, 1960
Phytophthora sp., 1293
seed-borne, 2057
evapotranspiration and yield, 991
Fe deficiency, 1303
fertilizers, 529, 644, 976, 991, 1007
flowering
and photoperiod, 1299*, 1300, 1805
and soil moisture, 1301*
and temperature, 1300, 1805
growth
and heat-sum index, 1302
and soil moisture, 1301*
and weather, 1302
growth substances, gibberellin, effect of, 1953
harvesting, 202
harvesting date, 718
heat-sum index and growth, 1302
herbicides, effect of, 171, 721, 1562
in Italy, 169
in Kenya, 202
in USA, 168*, 719
inoculation, 749, 1295, 1331
intercropping, and soil erosion, 465
irradiation, effect of, 1806
irrigation, 624
leaf
chemical composition, and pod removal, 1804
growth, 1300
light, incandescent v. fluorescent, and growth, 380
lodging and weeds, 1292
nodulation, 172, 722, 1332
nutrient translocation, 356
nutrition, 1193, 1303
photoperiodism, 380, 1299*, 1300, 1805, 1947
photosynthesis, 172, 356
plant population, 720, 1483
pod removal, effect of, 1804
rainfall and growth, 1302
root(s)
absorptive and excretory activities, 1938
cation-exchange capacity, 1960
growth, 1483
primary, tissues of, 1298*
rotations, 968
seed
chemical composition
cephalin content, 1822
lecithin content, 1822
oil content, 624, 1295
iodine number, 1804
protein content, 624, 1295, 1804, 1822
moisture equilibria, 1296
seed rate, 202, 720, 1295
seed treatment, 1297, 1803
seedling, effect of, 2,4,5-T on, 1304*
soil moisture
and weeds, 1292
effect of, 1301*
sowing date, 1295, 1299*
sowing depth, 1295
spacing, 202, 720, 1292, 1295
stem
chemical composition, and pod removal, 1804
growth and light quality, 380
temperature, effect of, 1300, 1302, 1805
varieties, 482
in Italy, 169
in USA, 170, 719
specific
Agate....380
Biloxi....380
Blackhawk....169
Clark....170, 1295
Flambeau....169
Ford....1294
Harosoy....1295
Hawkeye....1295, 1303
J.S.8....169
Kisa....169
Lincoln....170, 1295
Lindarin....1293
Ogden....169, 170
Perry....170
PI....1303
Roanoke....169
Wabash....170
water requirement, 1301*
water use and evapotranspiration, 991
weeds in, 171, 721, 1540
Abutilon theophrasti, 1292
Amaranthus retroflexus, 1292
Avena fatua, 1540
Setaria spp., 1540
S. lutescens, 1292
S. viridis, 1292
Sorghum halepense, 398
yield prediction and heat-sum index, 1302
yield trials, plot size, 1807*
Spacing, 1525 — see also individual crops
and net-assim. rate, 1477
Spain
agricultural statistics, 2067
agriculture, 2019
irrigation, 2019
maize, in Seville, 80
oil-seed flax, 1933*
potatoes, varieties, 782
rice, yields, 1228
safflower, 1455
weeds, 411
wheat, 1*, 1654
Sparrow — see *Passer domesticus*
Speedwell — see Weeds, *Veronica* sp.
Spergula arvensis — see under Weeds
Sphaceloma batatas, 291
Sphacelotheca sorghi, 104
Spirostachys spp. — see under Weeds
Spurrey — see Weeds, *Spergula arvensis*
Stachys arvensis — see under Weeds
Staggerweed — see Weeds, *Stachys arvensis*
Stainers — see *Dysdercus* sp.
Star grass — see *Cynodon plectostachyus*
Star thistle — see Weeds, *Centaurea calcitrapa*
Stellaria media — see under Weeds
Stem eelworm — see *Ditylenchus dipsaci*
Stem weevil — see *Ceuthorhynchus assimilis*
Stemborer — see *Busseola fusca* and *Sesamia* spp.
Stemphylium consortiale, 1377
Sternechus tuberculatus, 196
Stizolobium sp. — see Velvet beans
Storage, 901 — see also under Cereals, Root crops and individual crops
Streptomyces spp., 789
S. scabies, 252, 1854
Striga spp. — see under Weeds
Stylosanthes guyanensis, 749

Sudan, Republic of,
land use, 431, 1570*
millet, *Eleusine coracana*, 1221
weeds, *Eichhornia crassipes*, 1077
Sudan grass — see Sorghums, *Sorghum sudanense*
Sugar-beet (*Beta vulgaris* var. *saccharifera*), 1883
chemical composition
chloroplasts, 1350
Mn localization, 1968
CO_2, atmospheric flux of, 1994
cold resistance, 760, 761
cropping, mixed, 210
cultivation, hoeing, 1335, 1336
diseases, 1344*, 1632
Cercospora beticola, 213
Phoma betae, 1829
seed-borne, 2057
virus, 522
yellows, 215, 216*, 223, 888, 1345, 1832
dry weight and soil moisture, 219
evapotranspiration, 2048
factorial trial analysis, 497*
fertilizers, 37, 220, 754, 1353, 1613, 1838, 1839, 2038
fungicides, effect of,
Bordeaux mixture, 213
EMP, 1830
green manures, effect of, 1839
growth
and soil moisture, 1825
and water stress, 1351
growth substances, GA, effect of, 1352, 1834
harvesting, 1336, 1355
technique, in field expts, 1011
harvesting date, 1837
herbicides, effect of, 757*, 949, 1342
dalapon, 758
DCU, 758
propham, 211
simazin, 1730
sodium nitrate, 212
TBA, 2005
in Argentina, Buenos Aires, 1339
in Belgium, 1344*
in Gt Britain, yields, 1958–9, 1066
in Italy, 1337, 1338*, 1356*
in Sicily, 1073
insecticides
effect of, 1610, 2058
aldrin, 1830
γ BHC, 1830
dieldrin, 1830
disyston, 1832
rogor, 1832
thimet, 1832
irrigation, 206*, 754, 974, 1825, 1836
labour requirements, E. England, 1355
leaf
area
and heat and water balance, 2048
and soil moisture, 219
and photosynthetic rate, 1349
index and soil moisture, 1836
measurement, 1981
chemical composition
and fertilizers, 1838
and yellows, 888
diagnosis, 1353
growth and irrigation, 754
net-assim. rate and soil moisture, 216, 1836
nutrition, 1354
radiation reflexion, short-wave, 2048
stomata, chloroplasts, 759
transpiration and water deficit, 353
mechanization, 1011, 1335, 1336, 1355
Mg deficiency, 1632
Mn deficiency, 1632
Mo deficiency, 495
nutrient translocation, ^{36}Cl, 357
nutrition, 1632
on reclaimed land, 436
pests, 1344*, 1632, 2058
Agriotes spp., 1017
Athous haemorrhoidalis, 1017
Blaniulus guttulatus, 1343
Meloidogyne incognita acrita, 214
Myzus persicae, 215, 1345
Pegomyia betae, 1832
P. hyoscyami betae, 1831
Phoma betae, 1830
photoperiodism, 218
photosynthesis, 1349
plant population, 204, 752, 1337, 1824
polyploid, 753, 1347, 1828
determination, 759
root(s)
chemical composition
and fertilizers, 1838
glutamin content, 1837
sugar content, 1824, 1837
and fertilizers, 1839
and irrigation, 754
and purity, and vascular ring density, 1835
cold resistance, 761
formation and soil moisture, 1825
vascular ring density and sucrose content and purity, 1835
rotations, 575, 1339, 1582, 2038
seed
chemical composition, Mn localization, 1968
-cluster size, varietal differences, 753
drying, field, 756*
forms and labour economy, 1335
germination
and $CaCN_2$, 220
and rubbing, 1823
and size, 1823
polyploid/diploid seed, 1347
testing, 1348
size and germination vigour, 1823
vernalized, lab. identification, 217
viability testing by X-ray, 1833
seed-bed preparation, 1336
seed production, 210, 1357*
seed rate, 210, 752, 753
seed treatment, 1017, 1343, 1829, 1830, 1832, 1834, 2058
rubbing, effect of, 1823
seedling
emergence, polyploid/diploid, 1347
identification, 1346
singling, 205, 1335, 1336 — see also thinning below
soil moisture, effect of, 219, 1825, 1836
sowing date, 219, 1337
sowing method, 1335, 1336
precision drill, 752
ridged v. flat ground, 1334
spacing, 752
straw, ploughed-in, effect of, 2038
sugar content — see under root above
thinning, 1336, 1355, 1824 — see also singling above
varieties, 207, 208, 755, 1826, 1827
in Italy, 1340
in Netherlands, 209
specific
Battles N....1826
Battles N2....1826
Bush N....1826
Cesena NSA....1340
Dippe E....1334
Hilleshög....1828
Hilleshög R....753
Hilleshög R polyploid E....208
Hilleshög Standard....753
Johnson's N....1826
Klein AA....1337, 1341
Klein E....1826
Klein 2....1337
Kleinwanzleben....1828
Kleinwanzleben AA....1334
Kleinwanzleben E....218, 219, 753, 1334
Kleinwanzlebener Polybeta....753
Kuhn P-N....208
Maribo....1828
Maribo P polyploid....208
Maribo polyploid....753
Pedigrée E....1337
Rovigo AU....1341
Schreibers S.K.W. III....208
Sharpe's Klein E....1826
Zwaanesse III....753
Zwaanesse III-E....208
water deficit and transpiration, 353
water stress, effect of, 1351
weather, effect of, 1632
weeds in, 211, 212, 757*, 1335, 1342, 1540
Avena fatua, 758, 1540
Capsella bursa-pastoris, 2010
Chenopodium album, 2010
Setaria viridis, 1540
Stellaria media, 2010
Sugar millet — see Sorghum, *Sorghum dochna*
Sulphur, sources of, 883
Sunflower (*Helianthus annuus*)
B deficiency, 1495
cells, parenchymatous, structure of, 352
chemical composition, B content, protoplasm, 1495
Co excess, effect of, 1962
Cu excess, effect of, 1962
cultivation, 1457
drought resistance and micronutrients, 358
fertilizers, 358, 866
for fodder, 865, 2042
growth, 865
and light intensity, 1476
growth substances, effect of, 370
harvesting, 350
herbicides, 2,4-D, effect of, 346
in Germany, 2042
in Kenya, 350
in USSR, Rostov Prov., 1457

irrigation, 866
light, effect of
and GA, 370
on yield, 865
light intensity, effect of, 1476
Mn deficiency, 373
Mn excess, effect of, 373, 1962
net-assim. rate and light intensity, 1476
Ni excess, effect of, 1962
nutrition, 358, 1495, 1962
plant population, 344, 865, 1483
rainfall, and yield, 865
root(s)
absorptive and excretory activities, 1938
cation-exchange capacity, and nutrition, 1962
seed(s)
dormancy, absence of, in white mutant, 1458
drying, in-sack, 2064
germination, 865
hollow, causes of, 345
moisture content and irrigation, 866
N content, 866
oil content, 866
chemical composition, 866
weight, influence of, 344
seed rate, 350, 2042
seed storage, 2064
soil moisture
and hollow seeds, 345
and plant density, 865
sowing date, 865, 1457
sowing method, 1457
spacing, 344, 350, 2042
stem growth, 370
temperature and yield, 865
tissue culture, GA-like substance from, 371
varieties, 865, 866
weeds in, 1540
Zn excess, effect of, 1962
Sunnhemp (*Crotalaria juncea*)
as green manure, 1583
/roselle, comp. yields, 856
water use, 975
Sunn pest — see *Aelia* spp. and *Eurygaster* spp.
Swede-turnips (*Brassica napus* var. *napobrassica*)
cells, parenchymatous, structure of, 352
cultivation, 441, 442, 1359
fertilizers, 1613
herbicides, monoxone, effect of, 764
insecticides, effect of, 769
nutrient translocation, 392
nutrient uptake and cultivation, 442
nutrition, 392
^{32}P uptake, 392
pests, *Phyllotreta* spp., 769
root size and cultivation, 441
seed treatment, 769, 1359
sowing method, 1359
spacing, 1359
thinning, 762
double plants and yield, 762
types in Gt Britain, description of, 767
varieties
Bangholm....762
Bangholm 05....768
Fenix Bangholm 035....768
Light Purple Skin group, 767
weeds in, 764, 1359
Sweden
farming systems, cropping, in Västmanland Prov., 960
fodder plants, seed production, 1074
oat-breeding, a review, 1146
Sweet-clover (*Melilotus* sp.)
as green manure, 34, 621, 1647
clipping, and yield, 621
M. alba var. *annua*, 34, 621
M. officinalis, 371, 621
rotations, 623
tissue culture, GA-like substance from, 371
varieties, 621
Sweet-corn — see under Maize
Sweet-potatoes (*Ipomoea batatas*)
chemical composition, carotenoids, 1897
climate and transpiration, 809
cultivation, 288, 808*
diseases, *Sphaceloma batatas*, 291
fertilizers, 287, 288, 296, 810
growth, 1897
growth substances, effect of, 369
harvesting, 288
harvesting date, 297
in Belgian Congo, 287
in India, Bombay State, 288
in Kenya, 302
insecticides, effect of, 1895
intercropping, and soil erosion, 465
irrigation, 288
leaf, chemical composition, 287
nematocides — see insecticides above
pests, 288
Meloidogyne incognita, 1895
planting method, 288
root(s) — see also tuber(s) below
chemical composition, 812
rotations, 969
soil moisture and carotene content, 292
storage, 295, 296, 297, 1897
cold damage during, 811
transpiration and climate, 809
tuber(s)
chemical composition, 287, 812
and storage temperature, 811
ascorbic acid, 297, 1896
carbohydrate content, 810
carotene content, 292, 293, 294, 1896, 1897
pectic constituents, 295
sugar content and harvesting date, 297
cork, internal, 1409
curing, 297
growth and carotene content, 292
moisture content, 292
quality
cooking, 1409
processing, and K, 296
wound periderm formation, 297
varieties, 295
in Belgian Congo, 287
in Formosa (Taiwan), 291
in India, Bombay State, 288
specific
Allgold....289
B-4004....288
B. 52....810
B-5999....289
B-6271....289
Bayambang....290
Bentong Denayoro....290
Bigsi....290
Binalete....290
Binallena....290
Binuboy....290
Calabash Leave....287
Eskandarani....810
Gokoku....809
Goldrush....293
Hayato....294
Iningcanto....290
Initlog....290
Inubi....290
Kadali....290
Kainday....290
Kandee....289
Kang Kong 58....1894
Karingkit....290
Kenroku....294
Kyushu No. 12....294
Lubang....290
Mafutha T. 1408
Maryland Golden....296
Morong....290
Nancy-Hall....294
Nemagold....296
Norin No. 1....809
Norin No. 2....809
Norin No. 6....294
Okinawa No. 100....809
Oklahoma 17....289
Orange Little Stem....292
P_{10}....291
P_{30}....281
P_{48}....291
Pelican Processor....293
Porto Rico....297
Rosales....290
Samar Big Yellow (Bed 21)....1894
Schichifuku....809
Sigurado....290
Sinawa....290
Spongha....290
Sunnyside....289
Tinambo....290
Tinayabas....290
White Star....290
Vanumuhini....287
Wennop....810
Yellow Jersey....292
weeds in, 288
yields of tops and tubers, 1894
Switzerland, fodder-beet varieties, 763
Sword beans (*Canavalia ensiformis*), 1631
harvesting, 202
in Kenya, 202
inoculation, 1331
pests, *Sternechus tuberculatus*, 196
seed rate, 202
spacing, 202
Syria, land use, 431
Tagetes minuta — see under Weeds
Taiwan — see Formosa
Take-all — see *Ophiobolus graminis*
Talis pedionoma, 712
Tall fescue — see *Festuca elatior* var. *arundinacea*
Tall wheatgrass — see *Agropyron elongatum*

Tanganyika
agriculture, 1633
farming systems, Pangani Dist., 453*
Taraxacum spp. — see under Weeds
Taro — see Cocoyams
Tarophagus proserpina, 301
Tartary buckwheat — see Weeds, *Fagopyrum tataricum*
Teff — see *Eragrostis* spp.
Tephrosia candida, cross-inoculation, 749
Teramnus uncinatus, cross-inoculation, 749
Tetranychus telarius, 313
Thlaspi arvense — see under Weeds
Thrips — see *Frankliniella* spp., *Hercothrips fumipennis* and *Thrips* spp.
Thrips spp., 1928, 1929
Tillage — see Cultivation
Tilletia contraversa, 1110, 1659
Timothy — see *Phleum pratense*
Tipula spp., 487
'Torbo' disease — see *Rosellinia* sp.
Toria (*Brassica campestris*), rotations, 1921
Transpiration — see under Plant(s)
Trees, shelter, research, 448
Tribolium spp., 1202
T. castaneum, 183, 650
Trifolium spp. — see Clover
Trigonella foenum-graecum — see Fenugreek
Triticale (rye × wheat), 1676
Triticum spp. — see also Wheat
nomenclature, 1281
Trypopremnon spp., 1380
Turkey
barley, varieties, 60
land use, 431
Turnips (*Brassica rapa*)
costs, in Scotland, 599
fertilizers, 772
for fodder, 2041
as silage, 225
harvesting date, 225
herbicides, monoxone, effect of, 764
identification, 1993
sowing date, 772, 1414
sowing method, 225
varieties, 225, 770, 772
weeds in, 764
Turnip-rape — see Rape, *Brassica campestris* var. *oleifera*
Tussilago farfara — see under Weeds
Typha spp. — see under Weeds
Uganda, farming systems, Namulonge, 1907
Ulex europaeus — see under Weeds
Ultrasonic vibration and plants, 68
Union of S. Africa — see South Africa
Urena lobata
diseases, *Macrophoma urenae*, 1450
retting and fibre quality, 338
seed treatment, 1450
v. jute, 1450
var. D.S. 13....1450
Urid — see Beans, *Phaseolus mungo*
Urtica spp. — see under Weeds
USA
agricultural statistics, 2067
climate, 476*
crops — see also under States below
cotton, 303
maize, 72
soyabeans, 168*
farming systems, 454*
States
Alaska, weeds, 412
Colorado, sub-irrigation, 971
Florida
maize, 73, 1174
sub-irrigation, 971
water resources, 458
Illinois, oat varieties, 590*
Indiana, cereal varieties, 147*
Kentucky, soyabean varieties, 170
N. Carolina
barley varieties, 1792
cotton varieties, testing methods, 1922
oat varieties, 1792
rye varieties, 1792
wheat varieties, 1792
N. Dakota, soyabeans, 719
Texas, rice, 664
tree-shelter research, 448
water balance, maps, 2049*
windbreaks, in N. Great Plains, 981*
USSR
agricultural research, 484
agriculture, 429
climate, 2053*
crops
cotton, 1440
maize, 622, 1440, 1739
sorghum, seed production, 1440
sunflower, in Rostov Prov., 1457
wheat, in W. Ukraine, 1046
drainage schemes, 444
farming systems, S. Ukraine, 2036*
irrigation, 444
in Kulunda, 2037*
in S. Ukraine, 2036*
land reclamation, saline soil, Uzbek, 1578
land use, 2026
water conservation, 1593
Ustilaginoidea virens, 1759
Ustilago spp., 1109, 1711*
U. avenae, 591
U. hordei, 591
U. nuda, 1154
U. tritici, 16, 17, 1107, 1108
Varieties — see Crop(s) and individual crops
Vegetation
of Africa, maps, 1567
Belgian Congo and Ruanda Urundi, 1571
of São Tomé and Principe Is, map, 2021
Velvet beans (*Stizolobium deeringianum*), 1631
as green manure, 1583
chemical composition, N content and temperature, 1326
flowering, 1326
growth, 1326
harvesting, 202
in Kenya, 202
nodulation, 1326
photoperiodism, 1326
rotations, 968
seed rate, 202
spacing, 202
temperature, effect of, 1326
Velvet leaf — see Weeds, *Abutilon theophrasti*
Vernalization — see individual crops, seed
Vernonia baldwini—see also under Weeds
bud dormancy, 932, 933
Veronica sp. — see under Weeds
Verticillium dahliae, 326
Vetch (*Vicia* spp.)
general
as green manure, 450
cropping, mixed, 1821, 2041
for fodder, harvesting date, 2041
lodging, 1821
rotations, 969
seed, protein content, 1333
spring-sown, 1074
weeds in, *Agropyron repens*, 394
V. sativa, 1631
bibliography, 1089*
cropping, mixed, 548
flowering and nodulation, 1329
for forage, 548, 1631
Mn deficiency, 373
Mn excess, damage, 373
nodulation, 132, 1329
nodule, effect of overwintering on, 1329
seed, chemical composition, 1822
V. villosa
as green manure, 598
seed, chemical composition, 1822
Viburnum opulus, 215
Vicia spp. — see under Beans and Vetch
V. faba — see under Beans
V. obscura, cross-inoculation, 749
V. sativa — see Vetch
V. villosa — see Vetch
Vigna spp., 1631
V. catjang — see Cowpeas, *V. unguiculata*
V. mungo — see under Beans
V. sinensis — see Cowpeas
V. unguiculata — see Cowpeas
Virus diseases, 522 — see also under Legumes and individual crops
border crop protection against, 745
Voandzeia subterranea — see Bambarra groundnuts
Voles, seed protection against, 2059
Water — see also Irrigation, Soil moisture and Soil and water conservation
availability and soil condition, 1479
control in agriculture, 458, 1055*, 2068*
resources
and agriculture, 458
in arid regions, 521*
/soil relations, 2087*
Water couch — see Weeds, *Paspalum distichum*
Water hyacinth — see Weeds, *Eichhornia crassipes*
Water requirements, crops — see under Crop(s) and individual crops
Water rice — see *Zizania aquatica*
Water use, by plant — see under Plant(s) and individual crops
Watsonia — see Weeds, *Watsonia* spp. and *Chasmanthe aethiopica*
Weather — see also Agricultural meteorology, Climate, Micrometeorology, and Plant(s), environment

and crops
barley, 1790
maize, 1722
oats, 1790
peas, seed-bed preparation, 185
potatoes, 1866
rye, 1149
soyabeans, 1302
wheat, 1790
cold damage, studies, 898
drought, in Sweden, prolonged periods forecast, 2051*
frost
effect of
on barley, 702, 1800
on oats, 702, 1800
on rye, 702
on sugar-beet, 760, 1632
-heaving of soils, measurement, 1603*
in Canada, and agriculture, 1602
frost resistance — see Plant(s), environment
hail damage
in E. Germany, 471
to sugar-beet, 1632
hail-storms, in Belgian Congo and Ruanda Urundi, 2052*
heat damage, to sweet-corn, 1749
in Gt Britain, maps, 1060*
lightning damage, to sugar-beet, 1632
rain-drops, effect on soil of, 1587
rainfall
and crops
barley, 1790
cotton, 479, 842, 1435
groundnuts, 1306, 1595
Jerusalem artichoke, 1900
lupins, 197
maize, 623, 1595, 1722, 1742
oats, 1790
potatoes, 781, 1847*, 1848
rice, 479
sorghum, 479
wheat, 479, 575, 1093, 1684,1790
and saline soils, 467
artificial, 530*
in Gt Britain and N. Ireland, averages 1916–50, 1604*
in Portugal, 477*
in Port. Guinea, 478*
in Sweden, prolonged periods forecast, 2051*
intensity data, frequency analysis of, 475
probability estimation, 475
wind
and CO_2 content of atmosphere, 1995
speed and plant growth, 1484
winterhardiness — see Plant(s), environment
Webworm — see *Talis pedionoma*
Weeds, 420, 522, 532, 1528, 1550, 1551, 1557, 2015, 2069*, 2081, 2083
and duration of arable cropping, 2040
and soil type, 1640*
aquatic, 406, 420, 926, 941, 2004
algae, 124, 1547
competition, 64, 413, 707, 736, 1548, 2010
control
and rainfall conservation, 1595
and soil erosion, 1554
growth, in water culture, 1549*
identification, 522 — see also under Seed(s) below
in Belgium, 2006
in Ceylon, 1554
in Spain, 411
in USA, Alaska, 412
introduction, into New Zealand, 2007
mixed populations and selective herbicides, 734
nomenclature, 2006, 2081
nutrition, B, 1549*
ploughing, effect of, 1534
resistance to herbicides, 1556
scrub control, Gt Britain, 408
seed(s)
dispersal, 945, 2007
excretion by birds and viability, 2008
germination, bibl., 1089*
identification, 522, 1535
irradiation, effect of, 2017
longevity, 944*
survival in soil after cultivation, 2009
viability after bird excretion, 2008
specific
Abutilon theophrasti, 83, 920, 1292
Acacia sp., 409
A. hebecladoides, 939
A. pennata, 939
A. nigrescens, 939
Adenium spp., 409
Agave sp., 409
Agropyron repens, 101, 394, 397, 414, 708, 906, 907, 908, 1185, 1529, 1530*, 1540, 2001, 2010
Albizzia spp., 409
Alca spp., 409
Alisma sp., 670
Alopecurus aequalis, 1542
Amaranthus spp., 560, 921
A. hybridus var. *quitensis*, 1085
A. retroflexus, 83, 415, 1292
Ambrosia artemisiifolia, 721
Ammi jus, 1085
A. visnaga, 1085
Artemisia absinthium, 1540
A. vulgaris, 935
Asphodelus tenuifolius, 1541
Avena spp., 192, 707, 909, 910, 911, 912, 913, 1535
A. fatua, 393, 414, 758, 1540, 1999, 2000
Avicennia nitida, 671
Bidens spp., 560
Brachystegia sp., 1544
Brassica arvensis, 707
B. hirta, 736
B. tournefortii, 914
Bromus secalinus, 945
Caladium bicolor, 1309
Camelina sp., 1446
Capsella bursa-pastoris, 2009, 2010
Cardaria draba, 936
Carduus acanthoides, 1085
C. nutans var. *macrocephalus*, 1085
C. pycnocephalus, 1085
Carthamus lanatus, 401
C. oxycantha, 1541, 1552
Centaurea calcitrapa, 401, 1085
C. jacea, 2008
C. melitensis, 1085
C. repens, 936, 1540, 2005
Chara spp., 670
Chasmanthe aethiopica, 915
Chenopodium spp., 655
Ch. album, 415, 921, 1085, 1321, 2008, 2010
Ch. cordobense, 1085
Ch. hircinum, 1085
Ch. murale, 1085
Ch. rubrum, 437
Chondrilla juncea, 926
Chrysanthemum segetum, 559
Cirsium arvense, 397, 916, 917*, 918, 936, 1185, 1540, 2005
C. vulgare, 1085
Conium maculatum, 1085
Convolvulus arvensis, 919, 920, 936, 1185, 1540, 1730, 2005, 2016
Coronopus didymus, 924
Cynodon dactylon, 1533, 1534, 1552, 1730
Cyperus sp., 670, 1786(4)
C. digitatus 1786(4)
C. esculentus, 395, 396
C. rotundus, 937, 1309, 1532, 1552
Dichrostachys spp., 409
Digitaria spp., 1730
D. sanguinalis, 1454
D. scalarum, 937
Diplotaxis tenuifolia, 1085
Eichhornia crassipes, 404, 405, 937, 940, 1075, 1077, 1552
Echinochloa crus-galli, 1771
Eleocharis plantaginea, 1234
Equisetum arvense, 1185
Euphorbia esula, 932, 933, 936, 2005
E. helioscopia, 1543
Fagopyrum tataricum, 921, 922, 923
Fimbristylis miliacea, 1786(4)
Galinsoga parviflora, 250
Geoffraea decorticans, 1545
Glaucium corniculatum, 1543
Helianthus spp., 560
H. ciliaris, 919
Hoffmanseggia densiflora, 919
Holcus lanatus, 2008
Homeria breyniana, 402
H. miniata, 402
Imperata brasiliensis, 399
I. cylindrica, 937, 2002
Lactuca sp., 560
Lycopsis arvensis, 1543
Mentha arvensis, 1185
Monochoria vaginalis, 1786(4)
Nassella trichotoma, 924
Olea spp., 409
Onopordon acanthium, 1085
Orobanche cernua, 943
O. ramosa, 410, 1546
Oryza spp., 672*, 1224, 1235
Oxalis cernua, 559
O. pes-caprae, 925
Pachypodium spp., 409
Panicum spp., 1730
P. crus-galli, 670
P. crus-galli var. *hostii*, 670
Papaver hybridum, 559
Parthenium hysterophorus, 560
Paspalum dilatatum, 926
P. distichum, 2004
P. vaginatum, 671
Phalaris arundinacea, 1533
Phragmites communis, 670

Picnomon acarna, 401
Pluchea lanceolata, 1552
Poa annua, 2009
Polygonum amphibium, 949
P. aviculare, 559, 732, 1321, 1454
P. convolvulus, 655, 707, 732, 921, 1540, 2008
P. lapathifolium, 64, 927, 928, 1009, 1548, 2013
P. pennsylvanicum, 927, 928
P. persicaria, 655, 670, 920, 921, 927, 928, 1540
Portulaca oleracea, 415
Pseudoberlinia sp., 1544
Pteridium sp., 938, 2090
Raphanus raphanistrum, 559, 560, 1321
Rhizophora racemosa, 671
Rhus radicans, 1540
Rumex sp., 1321, 1537
R. acetosella, 1538, 2008
R. paluster, 437
Saccharum spontaneum, 1552
Salsola kali, 921
Sanseviera spp., 409
Scirpus sp., 670
Scolymus hispanicus, 400
Sesbania punicea, 929
Setaria spp., 83, 655, 1730
S. italica, 736
S. lutescens, 630, 1292
S. viridis, 630, 1292, 1540
Sinapis arvensis, 413, 559
Solanum rostratum, 934
Sonchus arvensis, 916, 918, 936
Sorghum halepense, 398, 930, 931, 1531, 1552
Spergula arvensis, 1321, 1540, 2013
Spirostachys spp., 409
Stachys arvensis, 924
Stellaria media, 732, 1321, 2009, 2010, 2013
Striga spp., 615
S. asiatica, 942
Tagetes minuta, 403
Taraxacum spp., 415
T. officinale, 1185
Thlaspi arvense, 921
Tussilago farfara, 949, 1185
Typha sp., 670, 926
T. angustifolia, 670
T. latifolia, 670, 1539, 1540
Ulex europaeus, 1536
Urtica spp., 1185
Vernonia baldwini, 932, 933
Veronica sp., 1321
V. persica, 2009
Watsonia spp., 915
Xanthium californicum, 934
X. pungens, 934
X. spinosum, 934, 1085
X. strumarium, 1552
Xylopia spp., 409
Zizyphus lotus, 407, 2003

Weevil — see *Calandra oryzae*, *Ceuthorhynchus* spp., *Pachymerus acaciae*, *Premnotrypes solani*, *Rhigopsidius tucumanus*, *Sitona* sp., *Sternechus tuberculatus*, and *Trypopremnon* spp.

Wheat (*Triticum* spp.)
for fodder
as silage, 1275
chemical composition, protein content, 3
clipping, 3, 1789
cropping, mixed, 548, 2041
fertilizers, 3, 1789
grazing, effect of, 545, 1091
green manures, effect of, 1585
growth substances, GA, effect of, 568
harvesting date, 1275, 2041
in Japan, 3
in Mexico, 1092
in USSR, Stavropol, 548
irrigation, 1092
seed rate, 3
seed treatment, 1074
varieties, 3
for grain
branching, aerial, and detillering, 688
burning, effect of, 2044
chemical composition
gluten, 27
N content and dry weight, 1286
clipping, effect of, 1091, 1789
^{60}Co intake and accumulation, 904
costs, 545, 582*
cultivation, 545, 555, 1685
ploughing, 546
v. burning, and yield, 2044
rotary, and *Melolontha vulgaris*, 1114
shallow, 546
subsoiling, 4
detillering, effect of, 688
diseases, 1046
Erysiphe graminis, 1106
Tilletia contraversa, 1110
Ustilago tritici, 16, 17, 1107, 1108, 1109
drying, 161
ear(s)
branching and light, 713
characters and photoperiod, 24
formation
and light intensity, 1119
and N requirement, 1286
and photoperiod, 563
number of, and fertilizers, 715
-shedding, 31
sprouting in the, 1117, 1665
tryptophane biosynthesis in, 1671*
X-ray observation of, 1513
earing, nutrient translocation during, 129
fertilizers, 3, 5, 32, 33, 34, 35, 38, 52, 158, 550, 572, 573, 575, 576, 577, 578, 644, 714, 715, 1106, 1126, 1129, 1165, 1286, 1287, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1789, 1798, 1799
flowering
and growth substances, 21*
and heat damage, 1284
and light, 154, 380
and photoperiod, 154, 1673
fumigants — see insecticides below
fungicides, effect of, 40
grain
characters, varietal identification by, 13
chemical composition, 1272
and mechanical damage, 1124*
carbohydrate content, 573, 1124*
gluten content, 28*, 577
gluten quality, 572
hexosan content, 573,
hexose content, 573
lysine content, 29
N content, 572
N fractions, 574
N/P ratio and yield response to fertilizers, 1679
P_2O_5 content, 32
pentosan content, 573
polysaccharide content, 573
protein content, 29, 30, 32, 33, 34, 546, 707, 1124*, 1130
sucrose content, 573
zonal variation in, 30
damage, and chem. comp., 1124*
drying, 545, 581*, 1095, 1665
moisture content, 580, 1095
number
and fertilizers, 715, 1126
and heat damage, 1284
and tillering, 1118
quality, 545
and fertilizers, 32, 35
baking, 32, 1117
estimation, 1125
in Argentina, requirements, 1133*
-setting and photoperiod, 563
shrivelling, 19
varietal identification by, 12
water absorption and sprouting in ear, 1117
weight
and fertilizers, 715, 1126
and tillering, 1118
1000-grain, 19, 32, 572, 1091
green manures, effect of, 34, 449, 978, 1647
growth substances, effect of,
IAA, 21*
MH, 21*, 872
harvesting, 545, 555, 1095
harvesting date and dormancy, 1665
in Japan, 3
in USSR, W. Ukraine, 1046
inflorescence initiation and leaf size, 1946
insecticides, effect of, 1114
chloropicrin, 1665
HCN, 1132
hydrogen phosphide, 1131
methyl bromide, 1132, 1288
irrigation, 34, 549, 974, 1586
leaf
diagnosis, 1678
nutrition, 1680
size and inflorescence initiation, 1946
light quality, effect of, 154, 380, 713
lodging resistance, 1683
mulching, stubble-, effect of, 546
nutrition, 1678 — see also leaf above
and photoperiod, 1673
on reclaimed land, 435
pests, 18, 1046, 1131
Agriotes spp., 561

Anguillulina tritici, 17
Leptohylemyia coarctata, 1661
photoperiodism, 24, 154, 380, 713, 1286, 1673, 1946
plant population, 1483
rainfall
and green manuring, 1647
and yield, 479, 547, 575, 1093, 1684, 1790
respiration, and growth substances, 21*
rotations, 449, 547, 575, 1046, 1647, 1808
seed
fumigants, effect of,
chloropicrin, 1665
HCN, 1132
hydrogen phosphide, 1131
methyl bromide, 1132, 1288
germination, 1117
size, 1090
seed rate, 1660, 1681
seed storage, 1131, 1132, 1288, 1665
seed treatment, 1107, 1108, 1109, 1667
sodium, exchangeable, tolerance to, 1798
soil density and yield, 547
soil moisture, effect of, 34, 1093, 1130, 1682
soil type, effect of, 1126, 1684
sowing date, 2, 8, 24, 1090, 1660, 1682
spacing, 550
spikelet, brittleness, 26
stem(s)
ear-bearing, density of, and fertilizers, 1126
growth and light quality, 380
storage, 545, 579, 580, 1665
temperature, effect of, 1284, 1682, 1790, 1946
tillering and yield, 1118
varietal identification, by grain characters, 12, 13
vernalization, 1665, 1667, 1668*
yield factors, 1126
yield prediction, and soil moisture, 1093

general

× rye (*Triticale*), winterhardiness, 1676
carbohydrate metabolism, 22*
chemical composition
and nutrient-deficiency assessment, 571
Mn localization, 1968
protein content and fertilizers, 2043
sugars and frost resistance, 1677
zonal variation in, 30
climate, effect of, 30, 1126
cold resistance and DNC, 1285
cropping, mixed, 5
cultivation, 1009, 1047, 1080
ploughing date and weed control, 709
ploughing depth, effect of, 441, 442
surface, effect of, 441, 442
diseases, 6, 35, 545, 1016, 1047
Cercosporella herpotrichoides, 1660
Ophiobolus graminis, 1660
Penicillium spp., 40
seed-borne, 2057
Tilletia controversa, 1659
yellow-berry, 1662
drought resistance, 1675
and fertilizers, 35
evapotranspiration, 1093, 1600, 2048
fertilizers, 36, 37, 39, 43, 100, 494, 545, 555, 571, 1047, 1080, 1127, 1128, 1130, 1613, 1660, 1678, 1885, 2043
-fields, phytosociology of, 421
flowering and vernalization, 1666
frost resistance, 35, 1677
fungicides, arasan, effect of, 562
green manures, effect of, 465
growth, 23, 1009
and vernalization, 1666
spring/winter varieties, 566
herbicides, effect of,
DNC, 1285
fernoxone, 1541
MCA, 2013
simazin, 1730
in Gt Britain, 545, 1047
in India, 555, 1080
in Italy, acreage, 1071
in Morocco, Souss Plain, 422
in Spain, 1*
in USA, N. Dakota, 704*
in Yugoslavia, 583
insecticides, effect of,
Bayer 19639 (di-syston), 562, 1113
chlorinated camphene, 18
metasystox, 18
parathion, 18
thimet, 562, 1113
irradiation, effect of, 1467, 1519*, 1520
irrigation, 555, 1080, 1094, 1130, 1480
K deficiency, 567
leaf
area, and heat and water balance, 2048
chemical composition, and irradiation, 1467
growth, 25
nutrition, 1121
osmotic pressure and irrigation, 1094
phosphate metabolism in, 569*
production and clipping, 1091
radiation reflexion, short-wave, 2048
respiration and light, 1470
water content and irrigation, 1094
light intensity, effect of, 567, 1119
lodging, 3, 1091, 1660
Mn deficiency, 43, 1121, 1122
nodes, number at flowering, and vernalization, 1666
nomenclature, in Africa, 151
nutrient-deficiency assessment, 571
nutrient translocation, 1121, 1122
nutrient uptake, 1492
and cultivation, 442
and nutrient solution pH, 570
nutrition, 358, 564, 1122, 1123, 1667 — see also leaf nutrition above
on peat land, 1278
on reclaimed land, 436
pest resistance and fertilizers, 35
pests, 545, 1047, 1080, 1115
Cephus cinctus, 1112
Ditylenchus dipsaci, 592
Leptohylemyia coarctata, 1111
Melolontha vulgaris, 1114
Oscinella spp., 1115
Phytophaga destructor, 562
photoperiodism, 23, 563, 567, 1283, 1672, 1947
photosynthesis, 564, 1470
and irradiation, 1467, 1519,* 1520
pollen-grain germination, artificial, 152*
pollination, 153
radioactive waste accumulation in, 1990
root(s)
and irrigation, 1094
cation-exchange capacity, 1959
cold resistance, 1676
growth and cultivation, 441
rhizosphere, microbiological study, 1669*
rotations, 545, 969, 1127, 1921, 2043
and subsoiling, 1175
seed
-damage and -treatment, 40
dormancy, 1664
germination, 1665
and *Azotobacter*, 1943
testing, 1116
Mn localization, 1968
pigmentation, 1663*
viability, duration of, 351
seed production, 14
and detillering, 688
seed rate, 545, 555
and pest control, 1112
and weed control, 560
storage, 15, 40, 1131, 1132, 1288, 1665
seed treatment, 15, 16, 17, 40, 545, 562, 1080, 1111, 1113, 1661, 1664
for drought resistance, 1675
seedling
chemical composition and light, 567
diseases, chlorosis, K deficiency, 567
growth, 1642*
and irradiation, 1467
nutrient uptake, 20
nutrition, 567, 1670*
shoot
chemical composition, 1670*
morphology and leaf size, 25
sowing date, 545, 1080, 1120, 1283
sowing method, 1047
spacing, 1112
T. aestivum, 26, 35, 1658
T. compactum, 380
T. dicoccum, 10, 688
T. durum, 5, 27, 35, 1129, 1646, 1656, 1662
T. macha, 26
T. monococcum, 688
T. persicum, 904
T. spelta, 26, 1285
T. turgidum, 35

T. turgidum fa. *compositum*, 1119
temperature, effect of, 1286
undersown, 1274, 1582
varieties, 5, 19, 29, 31, 482, 572, 573, 703, 1046, 1080, 1278, 1648, 1650, 1653, 1658
and altitude, 705
drought-resistant, 1100
heat-resistant, 1284
in Brazil, 8
in Canada, 6
in Colombia, 557
in Gt Britain, 1047, 1096, 1097
in India, 10, 11, 555
in Italy, 1101
in Kenya, 1105, 1279
in Norway, S., 1277
in Spain, 1654
in USA, N. Carolina, 1792
in USA, N. Dakota, 704*
in Yugoslavia, 1104, 1657
rainfed conditions, adaptability to, 1658
red, dormancy, 1665
specific
Alegrete....8
Alexander....148
Alter....551
A.R.A. 61 × Atle....148
A.R.A. 52/3/3/3....148
Aradi....553
Artemovka....1284
Atlas 50....7
Atlas 66....7
Atle....148, 158, 1097, 1650, 1791
Atson....148, 1097
Aziziah 301....1656
Banco....1096
Bandeirantes....8
Bersee....1096, 1648, 1649
Bidi 17....1646
Blanka....1284
Bledsoe....7
Bonza....557
Butler....7
C250....11
C286....11
Canaleja....553
Canti....553
Capeiti 8....1656
Capelle (Cappelle)....576, 1791
Cappelle Desprez....551, 1096
Cappelli....1656
Carlo Gallini....1655
Carme 23....1102
Carstens VI....1099
Chancellor....7
Colônias....8
Combate....8
Cross 339....9
Dauno III....1656
Diamant....1652
Dominator....551, 1096, 1648
Dragone....552
Dual....7
Duro S.G. 3....1656
Erbachshofer Braun....1659
Falchetto....552
Flamingo....1096
Floreal....553
Frontana....8
Funone....552
Funotto....552, 1101
Fylgia II....1097
Garigliano....1656
Generosa fam. 7....1103
Graf Toerring II....1659
Grifoni 235 (B 52)....1656
H.462. A-3-4.2.3....9
Heges Früher....1659
Heines VII....1099, 1648
Heines Fasan....1098
Heines Koga....1098
Heines Peko....1098
Helvia....556
Heurtebise....551
Holdfast....1648
HS Burgweizen....1659
Hybrid 46....551, 1096, 1648, 1649
Jufy I....1097
Karat....1659
Kärn II....148, 592
Knox....7
Koga....1650
Koga II....148, 158, 1097, 1650, 1791
Konphad-25....554
LaPorte....7
Later....551
Leda....1099, 1649, 1791
Leonardo....552, 1101
Leone....552, 1101
Lerma 52....558
Little Club....380
Mado....1649
Mara....1101, 1120
Marne Desprez....551
Masters 57....551
Melanopus....1284
Menkemen....557
Miche....551
Milfast....551, 1096, 1648, 1651
Minister....1096
Montserrat....1654
N. 59....1096, 1648
Narodnaja....1284
Niphad-179....554
Niphad-345....554
Norin 52....3
Norrøna....1652
N.P. 52....555
N.P. 165....571
N.P. 200....10
N.P. 701....555
N.P. 710....2, 555
N.P. 718....555, 571, 578
N.P. 770....555
N.P. 809....555
N.P. 823....1658
N.P. 824....1658
N.P. 828....1658
No. 362. B.I.A.2....9
No. 367. AR.3.B.2.B....9
No. 367. BR.I.D.4.B....9
No. 447....553
No. 2808....558
No. 2809-2b-2b-1T....557
No. 2809-2b-4b-3b-1T....557
No. 4765-17b-3t-1B....557
Orgaz....553
Oued-Zénati 368....1646
Pané 2....1100
Pané 247....1100
Panter....551, 1649
Patrizio 6....1656
Peko....148, 1097, 1099, 1284
P.G. 1....8
Produttore....552, 1101
Progress....148
R. 37....552
R. Forlani....552
R.L. 2150/A....9
R.M.D.5 × Bersee No. 14....148
Rudest....551
Russello S.G. 7....1656
S. 13....552, 1101
S. Marino....552
S. Pastore....1101, 1655
Sabanero/1-....9
Safir....592
Saria....553
Saunders....1564
Seabreeze (American)....3
Seneca....7
Snøgg II....1277
Squarehead's Master....25, 1096
Stirpe C 2-6-1....1103
strain R-1....563
strain R-9....563
Super-Helvia....556
Svenno....148, 592, 1097, 1650, 1791
Tavero....1649
Teutonen....1650
Thatcher....22*, 1564
Timilia S.G. 1....1656
Titano....552
Trapeano....8
Trimesino de la Costa....1120
Trintecinco....8
Tripolino....1656
Valenciano....1120
Vermillion....7
Verna....552
Vigo....7
Vilmorin 53....551, 1649
Vivenza clavatino....552
Wahrberger Ruf....1659
Weibulls Kärn II....1098
spring/winter, 566, 1481, 1674*
white, dormancy, 1665
winterhardy, 565, 1481
vernalization, 1120, 1666
and winterhardiness, 565
water use, 1480, 1600
weeds in, 546, 555, 559, 707, 1080, 1552
and ploughing date, 709
Agropyron repens, 708, 2010
Amaranthus spp., 560
Avena spp., 707
A. fatua, 1540, 2000
Bidens sp., 560
Brassica arvensis, 707
Cardaria repens, 936
Centaurea repens, 936
Chondrilla juncea, 926
Cirsium arvense, 936
Convolvulus arvensis, 936
Euphorbia esula, 936
Helianthus sp., 560
Lactuca sp., 560
Parthenium hysterophorus, 560

Polygonum convolvulus, 707
Raphanus raphanistrum, 560
Sonchus arvensis, 936
winterhardiness, 1283, 1481, 1676
and vernalization, 565
Wheat bulb fly — see *Leptohylemyia coarctata*
Wheat stem sawfly — see *Cephus cinctus*
Whitefly — see *Bemisia tabaci*
White lupin — see Lupins, *Lupinus alba*
Wild lily — see Weeds, *Asphodelus tenuifolius*
Wild oats — see *Avena fatua*, *A. ludoviciana* and under Weeds
Wild potatoes — see *Solanum* spp.
Wild radish — see Weeds, *Raphanus raphanistrum*
Wild safflower — see Weeds, *Carthamus oxyacantha*
Wild turnip — see Weeds, *Brassica tournefortii*
Wind — see under Weather
Windbreaks, 446,* 447,* 448, 981,* 1589*, 1593, 2055
Winterhardiness — see under Plant(s), environment, and indiv. crops
Wireweed — see Weeds, *Polygonum aviculare*
Wireworms, 2058 — see also *Agriotes* spp. and *Athous haemorrhoidalis*
Witchweed — see Weeds, *Striga asiatica*
Wojnowicia spp., 711
Xanthium spp. — see under Weeds
Xanthomonas malvacearum, 820, 831, 1913
Xylopia spp. — see under Weeds
Yam beetle — see *Heteroligus* sp.
Yams (*Dioscorea* spp.)
cultivation, ridge v. mound, 300
D. esculenta, 814, 1898
harvesting, 302
in Kenya, 302
nutrition, 1898
pests, *Heteroligus* sp., 1412
seed rate, 302
seed treatment, 1412
seed-tuber(s)
cut, 814
size and yield, 814
sett preparation, 300
size, 300
spacing, 302
tuber(s), aerial, formation, and sugar, 1898
Yellow lupin — see Lupins, *Lupinus luteus*
Yugoslavia
agricultural statistics, 2067
wheat, 583
varieties, 1104, 1657
Zea mays — see Maize
Zizania aquatica, 1788
Zizyphus lotus — see under Weeds

ANNUAL AUTHOR INDEX, VOL. 12, 1959

References are to abstract numbers. R.A. = Review article

Aartsen, J. P. van, 428
Abdel-Wahab, A. E., 792
Åberg, E., R.A. p. 169
Abraham, E. V., 675
Abraham, N.J., 339
Abrams, R., 1693
Acharya, C. N., 571
Acosta, J. C., 241
Adair, C. R., 678
Adda, —, 1217
Aden. Emp. Cott. Gr. Corp., 848
Adkisson, P. L., 837
Afanasiev, M. M., 251
Africa
  ALDEV, 2028
  Ass. Étude Taxon. Flore Afr. Trop., 1634
  Comm. Tech. Co-op. in Afr. S. of Sahara (CCTA), 405, 1075, 1312, 2082
  CSA, 405, 2082
  E. Afr. Agric., For. Res. Org., 635, 916
  E. Afr. High Comm., 1020, 1619
  Inter-Afr. Phytosanit. Comm., 503, 1528
  W. Afr. Rice Res. Sta., Rokupr, 671
  W. Afr. Stand. Adv. Cttee, 1023
Agadžanjan, G. H., 229
Agric. Group Soc. Chem. Industr., 1067
Agric. Res. Coun., Gt Britain, 2069
Agronômico, Campinas, 309
Ahmad, R., 1921
Ahmed, E. M., 295
Aimi, R., 1252
Air Minist. Met. Off., Gt Britain, 476, 2056
Akeley, R. V., 240, 1842
Åkerberg, E., 589, R.A. p. 169
Akman, A. V., 60
Albareda, J. M., 570, 1123
Alberda, T., 1984
Albuquerque, J. F. M., 477
Alder, E. F., 1734
ALDEV, 2028
Aldrich, D. T. A., 1091
Algeria
  Gouv. Gén., Insp. Gén. Agric., 559
  Gouv. Gén., Sect. Pédol. Agrol., 1223, 1267
Allen, E. F., 336
Allen, F. C., 734
Allison, F. E., 991
Allos, M. F., 1332
All-Union Sci. Inst. Cott. Res., Taškent, 1440
Alofs, M., 1633
Alonso, M. E. A., 1295
Alphen, T. G. van, 1965
Amarnath, L., 173, 1809
Amaro, J. P. P., 1312
Ambasht, R. S., 943
Amin, J. V., 1914
Anand, S. C., 1150
Ananthakrisha Rao, P. N., 110
Anderlini, R., 14, 552
Andersen, S., 1139
Andersen, T., 49
Anderson, J. C., 1175
Anderson, L. D., 1608
Anderson, L. E., 931
Anderson, O., 1532
Andersson, G., 1460, 1461
Angeles, N., 679
Anselme, C., 1927
Anson, R. R., 305
Anthony, K. R. M., 1221
Antoniani, C., 1829, 1966
Apte, M. V., 288
Arai, M., 709, 1542
Arata, H., 3
Argentina
  Esta. Exp. Pergamino, 41, 50, 61
  Sec. Agric. Ganad., 951
  Cent. Reg. Pamp. Investig. Agríc., 341
Arjan Singh, 17
Arléry, R., 2088
Armiger, W. H., 1482
Army, T. J., 1647
Arndt, F., 757
Arnold, P. W., 484
Arnold, R. E., 1145, 1166
Arruda, H. V., 1770
Artner, X., 277
Artschwager, E., 1835
Arvizu, R. Z., 36
Asakuma, S., 1257
Ashour, W. A., 828, 829
Ashton, W. M., 45
Aslyng, H. C., 365, 2055
Aspinall, D., 64, 609, 1548
Ass. Étude Taxon. Flore Afr. Trop., 1634
Atkins, E. L., Jr, 1608
Aubréville, A., 1634
Audia, W. V., 1859
Audus, L. J., 2083
Auerbach, S. I., 903
Aufhammer, G., 1630
Aukema, J. J., 1448
Australia
  Aust. Acad. Sci., 983
  Aust. N.Z. Ass. Adv. Sci., 2068
  Aust. Soc. Pl. Physiol., 1642
  Bur. Agric. Econ., Canberra, 1892
  CSIRO, 483, 595, 610, 926, 966, 1083, 1456
  Dep. Prim. Industr., Div. Agric. Prod., 1308
  N.S.W. Dep. Agric., 651, 924, 1084
  Queensland Univ. Dep. Agric., 1210, 1211
  Tasmania Dep. Agric., 488, 1321, 1385, 1553
  Victoria. Waite Agric. Res. Inst., 547, 609, 612, 1505
  Western. Fmrs' and Scient. Jt Conf., 540
Ayyangar, G. S., 1422
Bach, M. K., 172
Bachmann, L., 1900
Bailes, J. P., 1187
Bailey, W. K., 179
Bain, R., 1137
Baird, B. L., 1744
Bajpaye, N. K., 121
Baker, D. G., 989
Bakermans, W. A. P., 224, 766
Balakrishna Rao, K., 137
Balasubramanian, C., 1750
Baldacci, E., 2057
Baldanzi, G., 2044
Baldauf, D., 1815
Baldoni, R., 1656
Ballatore, G. P., 1127, 1334, 1337, 1338
Bannink, L., 322
Baptista, J., 135
Baptista, J. E., 1240
Baranger, M., 1967
Barbagallo, L., 1353
Barber, S. A., 644
Barberi, B., 1356
Bardner, R., 1111, 1661
Bardsley, C. E., 884
Barjac, H. de, 1330
Barley, K. P., 2066
Bärner, J., 490, 531
Barnes, D., 87, 164
Baron, D., 807
Baron-Hay, G. K., 1573
Barrie, J. W., 426
Barrow, P. McK., 604
Bartholomew, W. V., 1332
Bartlett, B. O., 1802
Bartz, J. F., 252
Basak, K. C., 425
Basutoland Dep. Agric., 100
Bayer, D. E., 927, 928
Beament, J. W. L., 1516
Beatty, G. F., 1568
Bederker, V. K., 1416, 1439
Beddows, A. R., 25
Beek, L. C. V., 1490
Beesley, D. W., 1689, 1691
Behr, A. B. P. G., 1594
Beingolea, G. O., 1434
Belderok, B., 1117
Belgian Congo. INÉAC, 312, 526, 892, 998, 1079, 1331, 1571, 2052
Belgium. Pl. Breed. Sta., Lemberge, 1021
Belikov, I. F., 356
Bell, G. D. H., 1055
Bell, R. S., 85, 786
Bellis, E., 1575
Belousov, M., 1904
Benavídez, C. C., 2024
Bendelow, V. M., 56
Benedetto, P. Di, 1353
Beni, U. De, 1230
Bennet-Clark, T. A., 1945
Bennett, M. K., 1602
Bennett, W. F., 1740
Bennison, R. H., 1417
Bergemann, H.-D., 1884
Berger, K. C., 252
Bergerson, F. J., 722
Bernardes, B. C., 662, 1222
Bernardes, I. A. C., 1222
Bernstein, L., 1798
Bertels, M. A., 632, 1612

Berthelem, P., 195
Bertrand, A. R., 2085
Bertrand, D., 887
Bertrand, G., 1969
Bespalov, N., 1420
Best, R., R.A. p. 85
Best, R. H., 953
Bethmann, W., 1116
Bézanger-Beauquesne, L., 1500
Bhat, N. R., 840
Bhatnagar, P. S., 109, 121
Bhatt, J. G., 319
Biebl, R., 1806
Bilham, E. G., 521
Bingefors, S., 1333
Bird, I. F., 1122
Birecki, M., 1868
Bishop, L. R., 1156
Bisset, G. B., 504
Björklund, C. M., 867
Bjorkman, O., 1985
Björling, K., 216
Black, C. A., 527
Black, J. N., 1476, 1477
Blackman, G. E., 419, 505, 1476, 1477
Blagburn, C. H., 504
Blair, E., 970
Blanc, D., 1192
Bland, B. F., 1690
Blaney, H. F., 474
Blunt, C. F., 965
Blyth, F. G. H., 460
Bobčenko, V. I., 974
Bodlaender, K. B. A., 1384, 1389
Boekholt, K., 145
Boer, H. ten, 1855
Boerendonk, M. J., 2029
Bokarev, K. S., 1861
Boldyrev, N. K., 1678
Bolhuis, G. G., 730, 1314, 1811
Bolton, J. L., 347
Bond, G., 1468, 2084
Bondarenko, D. D., 917
Bonde, E. K., 190
Bonfiglioli, O., 1104
Bonnemaison, L., 1928
Bonnet, J. A., 1741
Bonnet, P., 1596
Bonnier, C., 1331
Boock, O. J., 281
Booth, A., 1980
Bordas, A. J., 1760
Börner, H., 413
Borrill, M., 1946
Bos, L., 747
Bosman, J. C., 1358
Bosquet, J., 1514
Bothe, F., 1843
Bottini, E., 1496
Botton, H., 203
Boulaine, J., 1267
Bounds, N., 1010
Bournier, A., 1928
Bowden, J., 833, 834
Bowen, H. J. M., 2017
Box, J. E., 379
Boyd, A. E. W., 205
Boyd, A. G., 1415
Boyd, D. A., 1291
Boyd, F. T., 1174
Bradford, W. W., 1915
Brady, J. J., 148
Brandolini, A., 1179
Brassington, N., 1471
Bräunlich, K., 1884
Brazil
  Inst. Agron. Sul, 8, 587, 627, 632, 929
  Inst. Rio Grand. Arroz, 111
  Vet. Univ. Buenos Aires, Fac. Agric., 900
Brauer, A., 160, 493
Bregetova, L., 845
Brentzel, W. E., 1016
Bressani, R., 95
Brewbaker, H. E., 1835
Brian, P. W., 1162, 1485
Brill, G. D., 1518
Brim, C. A., 1807
Brisley, H. R., 1920
Bristol Univ., Dep. Econ., 2089
British Guiana. Dir. Agric., 144, 663, 857
Brit. Weed Contr. Coun., 532
Brockhuizen, S., 1278
Bromfield, S. M., 1142
Bronckers, F., 830
Brooke, C., 657
Brouwer, W., 791, 1587
Brown, C. H., 825
Brown, C. M., 590
Brown, C. W., 1687
Brown, D. M., 1302
Brown, J. C., 22, 1303
Brown, L., 1377
Brown, P., 1583
Browne, D. A., 1502
Bruce, R. C., 77
Brücher, E. H., 1282
Brücher, H., 1881
Buchholtz, K. P., 906, 907, 908, 928
Buchli, M., 1152
Budyko, M. I., 2053
Buelow, F. H., 1290
Buffa, G., 667, 1768
Bukovac, M. J., 873
Bulat, H., 1348
Bull. Madagascar, 958
Bullen, E. R., 1717
Bultot, F., 2052
Bumpus, E. D., 1585
Bünsow, R., 874
Bunting, A. H., 180
Bunting, E. S., 1177, 1720, 1725
Bur. Agric. Econ., Canberra, 1892
Bur. Dével., Prod. Agric. Outre-Mer, 1566
Burns, R. E., 198
Burrell, W. D., 1689, 1691
Burriel, M. F., 1509
Burton, W. G., 283, 284
Burvill, G. H., 468
Bussler, W., 373
Butany, W. T., 681
Butterfass, T., 759
Button, E. F., 278
Buttrose, M. S., 1157
Buxton, E. W., 737
Bylterud, A., 1529
Cabell, C. A., 649
Caborn, J. M., 448
Cabral, A. L., 1580
Cada, E., 120
Cadiz, T. G., 241
Cairaschi, E. A., 1888
Caldwell, F., 156, 1716
Caldwell, R. M., 147
Callbeck, L. C., 254
Calzada, B. J., 804, 1418
Cameron, J. W., 1749
Canada
  B.C. Dep. Agric., 997
  Dep. Agric., 6, 347, 523, 1844
  Quebec Soc. Protect. Pl., 655, 785
Candura, G., 961
Canecchio, V., 726
Canham, A. E., 362
Canvin, D. T., 910
Care, M., 748
Carlson, C. W., 71
Caro, J. A., 1543
Carson, G. P., 1651
Carton, H., 1888
Casas, E. de las, 1202
Casella, A., 697
Cashmore, W. H., 505
Castro, F. Suarez de, 1197
Caswell, G. H., 167, 653
Catala, R. L. A., 427
Catambay, A. B., 1763
Cauderon, A., 1726
Cave, W. E., 429
Ceapoiu, N., 2078
Cent. Cerealicult., Madrid, 613
Cent. Jute Cttee, Calcutta, 856, 859
Cent. Ld Problems Nr East, 431
Cent. Off. Inform., London, 502
Cent. Pl. Prot. Sta., Amravati, 1081
Cent. Reg. Pamp. Investig. Agric., Argentina, 341
Chaffin, W., 482
Chakravarti, S. C., 339, 1932
Chambon, R., 1633
Chamura, S., 881
Chandnani, J. J., 578
Chandrasekharan, P., 1773
Chant, S. R., 299, 1411
Chavan, V. M., 672
Chem. and Industr., 189
Cheng, T., 1667, 1916
Chevalier, R., 19
Chiminco, 2002
Chinese-Amer. Joint Comm. Rural Reconstr. Pl. Industr., 443
Chinn, S. H. F., 1154
Chinoy, J. J., 103
Chiung, L., 993
Chopin, G., 1986
Chopin, M., 1986
Chorbajian, T., 1296
Chouard, P., 875, 1952
Choudhuri, H. C., 232, 515
Choudhuri, S. R., 232
Choyce, M. A., 1431
Christensen, M., 1345
Chu, S. M., 15
Chuan-Min, S., 1930
Ciferri, R., 124, 1233
Cillis, U. De, 1801
Clapham, A. R., 1052
Clark, B. E., 1815
Claver, F. K., 262, 1391
Clifford, H. T., 167, 653
Clinton, P. K. S., 1913
Coaker, T. H., 99, 835
Cobo, M., 725
Cohn, N. S., 1503
Coïc, Y., 1681
Cole, D. A., Jr, 1749
Colhoun, J., 486
Collier, D., 1723
Collier, J. W., 623
Colombia

Dep. Invest. Agropec., 557, 606, 629, 777
Minist. Agric., 1186
Comm. Hydrol. Onderz, T. N. O., 992
Comm. Tech. Co-op. in Afr. S. of Sahara (CCTA), 405, 1075, 1312, 2082
Commonw. Bur. Soils, 2087
Commonw. Mycol. Inst., 486
Commun. R.-L., 937
Conagin, C. H. T. M., 728
Conf. Phys. Cloud and Precipit. Part., Mass., 1955, 530
Conklin, H. C., 517
Consolani, E., 1752
Conv. Ann. Soc. Ital. Genet. Agr. Italy, 1337, 1340, 1341, 1356, 1357
Conv. Concim. Azot., Ital. Merid., Isole, 37
Cooke, G. W., 492, 505, 1005
Coppenet, M., 1854
Coppock, J. T., 2027
Corbett, M. K., 745
Corbetta, G., 667, 1269
Corby, H. D. L., 643, 977
Cordner, H. B., 1896
Cormany, C. E., 1824
Corns, W. G., 568, 922, 923
Costes, C., 1510
Cotte, A., 865
Cougnenc, F., 2019
Cowie, G. A., 529
Cox, A. E., 226
Cox, E. G., 852
Craft, C. C., 1402, 1859
Crafts, A. S., 947
Cragg, J. B., 1055
Crane, P. L., 1737
Crehu, G. du, 818
Crocker, R. L., 2068
Crooke, W. M., 1962
Crosier, W. F., 1733
Crossley, D. A., Jr, 903
CSA, 405, 2082
CSIRO, 483, 595, 610, 926, 966, 1083, 1456
Cufodontis, G., 1527
Culpin, C., 1336
Cumming, B. G., 393
Cunha, J. M. A., 135, 1240
Cunningham, C. E., 248
Currie, B. W., 995
Cyprus. Dep. Agric., 227, 343, 407, 864
Czaja, A. T., 352
Czechoslovakia. Univ. Brno, Sch. Agric. and For., 1640
Dadd, C. V., 146, 184
Dainty, J., 1393
Dalal, J. L., 1808
Dale, J. E., 842, 895
Dallyn, S. L., 286, 1399
Dalziel, J. M., 525
Damaty, A. H. El, 863
Danert, S., 1463
Daniľčuk, P. V., 1757
Dano, P. L., Jr, 78
Dantuma, G., 1283
Das, T. M., 51
Davidescu, D., 637, 714
Davidson, T. M. W., 260
Davies, J. C., 99, 652
Davis, D. E., 1562
Davis, L. L., 1762
Davitaja, F. F., 1593
Dawes, S. N., 980
Day, A. D., 1134
Day, B. E., 1563
de Barjac, H., 1330
De Beni, U., 1230
De Cillis, U., 1801
de Ferrière, P. J. J. Franc, 1684, 1885
De Fina, A. L., 951
de Franquen, P., 316
de Haan, J. H., 2045
Dehay, C., 748
de Jong, W. H., 1887
DeKock, P. C., 888
de la Fuenke, R. K., 131
de la Puerta, F., 80
De Lint, M. M., 788
del Rivero, J. M., 1428
de Luca, Y., 200
DeMent, J. D., 1493
Demol, J., 1316, 1435
Denmark. Stat. Forsøgsvirk. Plantekult., 735, 1098, 1138
Dent, J. W., 893
de Oliveira, A. J., 1012
Deonier, M. T., 297
Departments of Agriculture — see countries
de Ramos, M. B., 1270
Derscheid, L. A., 918
Desai, R. S., 1942
Deshmukh, N. Y., 340
de Tempe, J., 150, 850
Detilleux, E., 287, 1363
Detroux, L., 1342
Develop. Cent. Watershed Manage., India, 459
Dew, D. A., 1707
de Wit, C. T., 1225, 1525, 1940
Dharampal Singh, 199
Di Benedetto, P., 1353
Dickens, J. W., 1812
Dieckert, J. W., 727
Digar, S., 138
Dijkema, L. R., 1839
Dittmer, H. J., 1504
Dixon, G. E., 9, 1105, 1279
Dobben, W. H. van, 1160, 1284, 1286
Dobson, R. C., 1426
Dodds, M. E., 1707
Doherty, T., 1816
Doi, Y., 1251, 1513
Dolgušin, D. A., 566
Domańska, H., 1948
Donà dalle Rose, A., 1352
Donovan, L. S., 1982
Doorenbos, J., 793
Dord, D. C. van, 2000
Dore, J., 1243
Dorman, I., 1909
Doroganevskaja, E. A., 30
Dorph-Petersen, K., 1613
Dow, A. I., 81
Downs, R. J., 380, 1672
Drachovská, M., 217
Dreibelbis, F. R., 1480, 1600
Driscoll, G. R., 1207
Drozdov, S. N., 564
DSIR, Pest Infest Bd, 579, 611, 646
Duarte, E. F., 298
Ducet, G., 273
Duckham, A. N., 520
du Crehu, G., 818
Duerden, J. C., 183
Dumenil, L. C., 636
Duncan, A. A., 296
Duncan, W. G., 1191, 1483
Dunne, J. P., 221
Dunning, R. A., 1830, 1832
Duthil, J., 435
Dutt, N., 858
Eade, A. J., 1708
Early, J. D., 838
E. Afr. Agric., For. Res. Org., 635, 986
E. Afr. Fmr and Planter, 403
E. Afr. High Comm., 1020, 1619
Ebata, M., 1268
Ebert, D., 1011, 1190
Eck, H. V., 598, 1682
Eckroth, E. G., 1824
Eden, W. G., 1206
Edinb. E. Scot. Coll. Agric., 48, 58, 1147, 1289, 1406
Edwards, J. A., 464, 985
Edwards, R. S., 586, 1010, 1603
Edwardson, J. R., 745, 1753
Eger, G., 1975
Eich, D., 1582
Eijnattan, C. L. M. van, 86
El Damaty, A. H., 863, 866
El Hattab, H. S., 628
Eliasson, L., 378
El Kobbia, M. T., 863
Elliott, C. S., 1688, 1708
Elliott, H. G., 1443, 1444, 1445
Elliott, J. G., 414
Ellis, F. B., 902
Elstrand, E., 1003
Emden, J. H. van, 253
Emp. Cott. Gr. Corp., 326, 327, 820, 821, 822, 823, 831, 835, 841, 842, 848, 1431, 1442
Empson, D. W., 1140
Endrizzi, L., 1935
Ennik, G. C., 1525
Ente Naz. Sementi Elette, 552, 667, 891
Ergle, D. R., 846
Ermolov, V. G., 701
Ernould, L., 223, 1344, 1632
Erwin, D. C., 311
Escribano, I. F., 239
Esta. Exp. Pergamino, 41, 50, 61
Esta. Rieg. Córdoba, 625, 854, 855
Estácio, F. L. F., 973
Esteves-de-Sousa, A., 409
Estrada, R. N., 1371
ETAP, 583, 699
Europ. Brew. Conv., Barley Cttee, 605, 1630
Europ. Product. Agency, OEEC, 1605
Evans, A. W., 1650
Evatt, N. S., 1765
Everson, E. H., 1663
Ewing, E. C., 1915
Extermann, R. C., 1058
Eynard, I., 1227
Ezell, B. D., 292, 1897
Fabiani, L., 583, 1365
Fadígas, M., 313, 1381
Faivre-Dupaigre, R., 1730
Falanghe, O., 18
Falk, H., 382
Falk, J. E., 2084
FAO, 143, 149, 305, 420, 428, 431, 444, 459, 485, 517, 583, 669, 673, 699, 710, 989, 1631
Meet. Hybrid Maize, Wageningen, 1205

Farbrother, H. G., 841
Favero, A., 14, 552, 1102
Feddema, L., 415
Feddersen, H. D., 775
Fehrenbacher, J. B., 1176
Feiffer, P., 1692
Feingold, J. H., 1373
Feldman, I., 1545
Fenaroli, L., 1748
Fengchow, C. Ma, 443
Fernández, G. R., 34, 92, 1130
Fernando, H. E., 674
Ferraz, T. F., 1729
Ferrière, P. J. Franc de, 575, 801, 1684, 1885
Feyerabend, G., 1185
Fina, A. L. De, 951
Fischnich, O., 250, 607, 1335, 1856
Fitzpatrick, E. N., 540
Flamini, B., 1829
Fmrs' and Scient. Jt Conf., W. Aust., 540
Folkes, B. F., 1067, 2084
Foreman, M. S., 779
Forrest, J. D., 938
Forsberg, D. E., 921
Förster, K., 1956
Forster, R., 399
Forward, B. F., 44
Foti, S., 5, 1685
Fourré, J., 760, 761
Fourrier, P., 1306
Fowden, L., 1466, 1501, 1714, 2084
Franc de Ferrière, P. J., 575, 801, 1684, 1885
France
  Bur. Dével. Prod. Agric. Outre-Mer., 1566
  IRCT, 1441, 1450, 1451
  Soc. Encourage. Cult. Orges Brass. Houbl. Fr., 59
Franquen, P. de, 316
Frear, D. E. H., 533
Frederiksen, P. S., 333, 1926, 1929
Freeman, J. D., 518
Freeman, J. F., 170
Freire, E. S., 325
Frey, K. J., 1693, 1696, 1697
Fried, M., 1482
Friederich, J. C., 1923, 1924, 1925
Friedrich, J., 1004
Friesen, G., 707, 910, 1540
Friesen, H. A., 921
Frimmel, G., 46, 261
Fritzsch, K., 155
Fritzche, R., 331
Fruit Veg. Cann., Quick Fr. Res. Ass., Campden, 189
Fry, P. C., 1396
Fryer, J. D., 414
Fryxell, P. A., 1912
Fuente, R. K., 131
Fujii, S., 1261
Fujii, Y., 1249
Fujimaki, K., 1252
Fukaki, S., 129
Fukui, H. N., 90
Fukujû, H., 683
Fulton, J. M., 1844
Fu-Min, T., 1766
Funaioli, U., 957
Funderburk, H. H., 1562
Füredi, J., 1795
Fürste, K., 706
Fustec, E., 1119
G. Agric. Domen, 1655
Gaafar, A. K., 293
Gadd, L., 40
Gagnon, L. P., 655, 785
Gailey, F. B., 1519
Gall, H., 806, 1364
Gallais, J., 1758
Galli, F., 749
Galston, A. W., 1486
Galvez, N. L., 77
Ganguly, B. D., 555
Gangwar, L. C., 1934
Gantz, R. L., 631, 1561
Garay, O. A., 1339
Garbosky, A. J., 951
Garboua, M., 1229
García, P. E., 553
Gardner, F. P., 1789
Garin, A., 1976
Garin, K. S., 1906
Garnier, B. J., 994
Garot, A., 115
Gausman, H. W., 264, 265, 1860
Gay, P. A., 940
Gee, H. C., 458
Geidel, H., 498
Gelmetti, A., 213
Genuit, F., 2040
George, E. J., 981
George, F., 521
Gerasimov, I. P., 2026
Germany, Western
  Landw. Hochsch. Hohenheim, 757, 1549
  Nat. Conf. Advisors in Agric. Econ., Wangen/Allgäu, 1615
Gfeller, F., 6
Ghamrawy, A. K., 861
Ghana. Dep. Agric., 300, 338, 451
Ghyssaert, L., 853
Giang, P. A., 890
Giannesini, J.-P., 1646
Giglioli, E. G., 1224
Giles, W. L., 303
Gill, N. T., 522
Gillard, A., 1547
Gilmore, E. C., Jr, 1194
Gils, A., 892
Giorgi, E., 2033
Gisborne, J. H., 499
Glander, H., 136
Glover, J., 635, 986
Glynne, M. D., 1106, 1660
Goarin, P., 1234
Go Ban Hong, 134, 1778
Goffart, H., 1148
Gol'dberg, G., 1903
González, M. H., 1092
González, O., 1452
Gorrie, R. M., 1577
Gorter, G. J. M. A., 1310
Goss, J. A., 1991
Gostinchar, J., 411
Gough, H. C., 1462
Gould, W. L., 758
Gouny, P., 372
Govindaswami, S., 680, 1774
Graf, A., 1019
Grafius, J. E., 55
Graham, W. M., 650
Grammatikati, O. G., 1094
Graner, E. A., 1729
Granstaff, E., 482
Grassl. Res. Sta., Kitale, 1585
Gt Britain
  Agric. Group Soc. Chem. Industr., 1067
  Agric. Res. Coun., 2069
  Air Minist. Met. Off., 476, 1601 1604, 2056
  Bristol Univ., Dep., Econ., 2089
  Brit. Weed Contr. Coun., 532
  Cent. Off. Inform., 502
  Commonw. Bur. Soils, 2087
  Commonw. Mycol. Inst., 486
  DSIR, Pest Infest. Bd, 579, 611, 646
  Edinb. E. Scot. Coll. Agric., 48, 58, 1147, 1289, 1406
  Emp. Cott. Gr. Corp., 326, 327, 820, 821, 822, 823, 831, 835, 841, 842, 848, 1431, 1442
  Fruit. Veg. Cann., Quick Fr. Res. Ass., Campden, 189
  Hasler and Co., Ltd., Throws, 551, 740
  Inst. Brew., Analysis Cttee, 1155
  Inst. Corn Agric. Merch., 505
  Low Temp. Res. Sta., Cambridge, 189
  May and Baker, Ltd., 408
  Met. Off., Wld Climatol. Br., Harrow, 1638
  Minist. Agric., Fish., Fd, England and Wales, 165, 193, 455, 487, 501, 545, 773, 999, 1000, 1017, 1061, 1141
  NAAS, 1006, 1291
  Nat. Veg. Res. Sta., Warwick, 2009
  NIAB, 703, 741, 755, 767, 796, 1096, 1097, 1135, 1151, 1291
  NIAE, 280, 580, 588
  Norfolk Agric. Sta., Sprowston, 576, 732, 752
  N. Scot. Coll. Agric. Econ. Dep., 599
  Nottingham Univ. Sch. Agric., 54, 64, 807, 1002
  Pea-growing Res. Org. Ltd., 192
  Pl. Prot. Ltd., 1488
  Rothamsted Exp. Sta., 1006, 1660, 1661, 1791, 1799, 1816, 1830, 1832, 1836, 1857, 1877, 1954, 1959, 1963, 1981, 1994, 1999, 2010, 2038, 2039, 2048, 2058
  Roy. Comm. Common Ld, England and Wales, 954, 1636
  Scotland Dep. Agric., 979, 1000
  Shell Chem. Co., Ltd., 2081
  Soc. Exp. Biol., 2084
  Soil Surv., 950
  Symp. Biol. Prod. Brit., London, 430
  Symp. Util. Nitrogen, 2084
  Trop. Prod. Inst., London, 1065
  Univ. Coll. Wales, Aberystwyth, 1010, 1603
  Welsh Pl. Breed Sta., 25, 47
  W. Scot. Agric. Coll., 938
  Wye Coll., 953, 964, 1001, 1022
Green, H. C., 280
Green, J. G., 909, 911, 912, 913
Green, V. E., Jr, 83, 116
Greene, H., 521
Greenshields, J. E. R., 346
Grellet, J., 2020
Gries, G. A., 1666
Griffiths, D. J., 47
Grigor'ev, A. A., 2053

Grigsby, B., 920
Grillot, G., 118, 449
Grimm, H., 756, 1856
Grimm, H. G., 1833
Grišina, G. S., 1478
Grønnerød, B., 1277
Grosse-Brauckmann, E., 157
Grümmer, G., 1446
Grunes, D. L., 71, 1698
Guatemala. Minist. Agric., Serv. Coop. Interamer. Agric., 558, 616
Guerra, P. R. A., 519
Guillaume, A., 952, 1576
Guimarães, C., 478
Guljakin, I. V., 904, 1990
Gull, D. D., 275
Gunnarsson, O., 883
Guntz, M., 1854
Günzel, G., 1581
Gurnani, K. L., 334
Gursham Singh, 11
Gusev, N. A., 878
Gustafsson, N., 787
Guyer, G. E., 562
Guyot, S., 168
Haan, J. H. de, 2045
Haas, H. J., 1679
Haber, A. H., 1471
Haber, W., 1972
Habermann, H. M., 1458
Hackbarth, J., 1884
Hackbarth, W. P., 83
Haddock, J. L., 1392, 1394
Haertlein, H., 1133
Hagnauer, W., 2061
Hall, C. W., 648, 716, 1200, 1918, 1919
Halle, N., 203
Hallett, G., 1616
Hamid, A., 1541
Hamner, K. C., 1805
Hampson, G., 1716
Hanell, E., 491
Hanf, M., 67
Hanna, R. L., 315
Hanning, F., 274
Hansen, C. M., 440, 614
Harper, J. L., 75, 1170,
Harrison, E. M., 270
Harrold, L. L., 473, 1480, 1600, 1735
Hart, J., 1219
Harvey, N., 1063
Harvey, P. N., 1823, 1840
Hasegawa, G., 1264
Hashad, M. N., 619, 815, 816, 862
Hasida, S., 139
Hasler and Co. Ltd., Throws, 551, 740
Hatanaka, Shin-Ichi, 1931
Hattab, H. S. El, 628
Hattingh, I. D., 1538
Haughs, M. A., 599
Hauser, V. L., 2047
Have, H. ten, 695, 1226
Haw, R. C., 2086
Hawkes, J. G., 1882
Hawkins, A., 278
Hawkins, W. W., 1886
Hay, J. R., 393
Hayes, J. D., 1273
Hayward, P. R., 551
Heald, W. R., 1989
Healy, A. J., 2007
Heard, A. J., 1115
Heber, U., 360, 1677
Hecq, J., 423
Heick, F., 1849
Heidrick, L., 228
Heiken, A., 1374
Heinisch, O., 204
Heintze, S. G., 1959
Heldal, B., 480
Helgeson, E. A., 420, 909, 911, 912, 913, 936
Hellings, A. J., 1586
Hemberg, T., 259
Hendricks, S. B., 1947
Henkens, C. H., 374, 885, 1497
Herbold, —, 2001
Hernaez, A., 112
Hernández, S. R., 1198
Hershfield, D. M., 475
Hesling, J. J., 1280
Hewett, P. D., 1664, 1794
Hey, G. L., 1049
Heyes, J. K., 2084
Heyne, E. G., 7
Hicks, F. W., 1321, 1385
Hide, J. C., 1647
Higazy, M. A., 638, 639, 640, 641
Highkin, H. R., 1949
Hill, G. D., Jr, 397
Hill, M. J., 1791
Hine, H. J., 809, 1064, 1890
Hirai, G., 809
Hix, H., 1850
Hodges, R. J., Jr, 664
Hodgson, W. A., 1375
Hodnett, G. E., 817
Hoffmann, G. M., 410
Hofstra, D., 1887
Hogan, T. T., 143, 1787
Hogg, W. H., 1603
Holmberg, A.-M., 738
Holmes, R. M., 898
Hood, A. E. M., 158
Hopp, H., 944
Horber, E., 1114, 1610
Hori, S., 272
Horlacher, H., 35
Horowitz, B., 1456
Horsbrugh, A. S., 1289
Horst, K. ter, 717, 1309
Horváth, P., 1706
Horwitz, L., 355
Hoskins, W. G., 1636
Hosoda, K., 140
Hošpes, B., 1640
Howatt, J. L., 268
Hoyman, W. G., 1382
Hsi, C. H., 289
Hsieh, S. C., 1574
Hsing, C. Y., 1803
Hudson, J. P., 1515
Hudson, P. S., 1074
Huffaker, R. C., 1193, 1960
Hughes, J. M., 1167
Humphries, E. C., 69, 1386, 1857
Hunsader, M. L., 274
Hunziker, A. T., 1543
Hurtt, W., 1559
Hutchinson, J., 470, 525, 844, 1907, 2064
Hutter, W., 4, 437
Hwang, H., 1853
Idia, 432, 1372, 2025
Iljin, V. S., 1507
Ilyina, A. I., 1317
Imper, A. D., 599
India
  Agric. Res. Inst., Sch. Agric., New Delhi, 1082
  Cent. Jute Cttee, Calcutta, 856, 859
  Cent. Pl. Prot. Sta., Amravati, 1081
  Develop. Cent. Watershed Manage., 459
  Jute Agric. Res. Inst., 856, 859
Indian Cott. Gr. Rev., 304, 306, 847, 1423, 1424
Indian Fmg, 106
INÉAC, 312, 526, 892, 998, 1079, 1331, 1571, 2052
Ingebretsen, K., 1772
Ingold, M., 162, 1347
Ingram, W. R., 833, 834
Inkilä, O., 1652
Inkson, R. H. E., 799
Inoue, Y., 1810
Inst. Agron. Sul, Brazil, 8, 587, 627, 632, 929
Inst. Biol. Scheik. Onderz. LandbGew., Wageningen, 766, 1160, 1284, 1358, 1389, 1398, 1525
Inst. Bodemvrucht., Neths, 1819
Inst. Brew., Analysis Cttee, 1155
Inst. Corn Agric. Merch., 505
Inst. Cultuurtech. Waterhuis., Wageningen, 1586
Inst. Pl. Breed., Polish Acad. Sci., 1074
Inst. Rio Grand. Arroz., 111
Inter-Afr. Phytosanit. Comm., 503, 1528
Internat. Excurs. Phytosociol., Pavia, 421
Internat. Inst. Ld Reclam. Improve., 2031
Internat. Symp. Phosph. Nutr. Plants, Italy, 637, 714
Ionesco, T., 1526
Iraq. Cent Ld Problems Nr East, 431
IRCT, 1441, 1450, 1451
Ireland
  Northern. Minist. Agric., 328, 765, 800, 1000, 1276, 1550
  Republic of
    Dep. Agric., 255
    Minist Agric., 1703
Isaacs, G. W., 1506
Isebaert, L., 1710
Isenberg, F. M., 275
I-Shun, T., 688
Isleib, D. R., 271, 1401, 1869
István, I'só, 516
Italy
  Conv. Ann. Soc. Ital. Genet. agr., 1337, 1340, 1341, 1356, 1357
  Conv. Concim. Azot., Ital. Merid., Isole, 37
  Ente Naz. Sementi Elette, 552, 667, 891
  Internat. Excurs. Phytosociol., Pavia, 421
  Internat. Symp. Phosp. Nutr. Plants, 637, 714
  Sta. Chim.-agr., Roma, 79, 169
  World Congr. Agric. Res., Rome, 1801, 1883, 2044
Ito, K., 465
Ito, S., 489
Ivens, G. W., 939, 1544
Ivins, J. D., 54
Iwaki, H., 1686
Iwaki, S., 1266
Iwane, K., 1872

Iwata, T., 1237
Jackson, D. C., 975
Jackson, R. D., 1392, 1394
Jacobson, L., 1159
Jacoby, E. H., 521
Jaehni, G., 258
Jain, K. B. L., 1658
Jameson, H. R., 771
Jansson, G., 1712
Jarvis, R. H., 603
Jayaraman, M. V., 1750
Jeffrey, A. G., 455
Jenkins, C. F. H., 712
Jenkins, H. V., 1505
Jennings, I., 1636
Jensen, L. A., 704, 719, 936, 1016
Jensen, N. F., 2050
Jepson, W. F., 1115
Jercev, V. N., 1973
Jessup, J. R., 231
Joffe, A., 647
Joglekar, R. G., 340
Joham, H. E., 1914
Johansen, R. H., 1367, 1368
Johnson, B. G., 906, 907, 908, 1530
Johnson, G. R., 1876
Johnson, W. A., 234
Johnson, W. H., 1095
Johnston, A., 126, 1297
Johnston, A. E., 1963
Johnston, G. R., 1366
Jolly, A. J., 1588
Jones, S. T., 234
Jong, W. H. de, 1887
Jonker, J. J., 1158
Jönsson, E., 245
Jordan, H. V., 884
Jordan, L. S., 332
Jorritsma, J., 1838
Josefsson, A., 762, 768, 770
Joseph, E., 1865
Joubert, T. G. la G., 187, 1408
Joyce, R. J. V., 832
Juárez, G. L., 1425
Judin, B. F., 91
Judinceva, E. V., 904, 1990
Junges, W., 363
Junghans, K. H., 705
Juniper, B. E., 1511
Junosov, R., 1420
Jurčík, J., 1640
Ju-Shen, H., 310
Jute Agric. Res. Inst., 856, 859
Kägi, R. C., 2024
Kai-Chü, Y., 666
Kalacheva, V. Y., 1992
Kalisvaart, C., 2031
Kamal, M. A. M., 572, 573, 574, 866
Kamata, E., 751
Kamra, S. K., 1346
Kandeler, R., 349
Kaneki, Y., 1499
Kanervo, V., 2060
Kantack, E. J., 1409
Kanzler, F., 1110
Karapetjan, N., 2016
Karim, A., 133
Karr, E. J., 1323
Kartoffelbau, 1843, 1884
Karwowska, Z., 1971
Kashibuchi, H., 1872
Kashiwakura, Y., 1262
Kataoka, T., 709
Katayama, Y., 729, 731
Kavanagh, L. R., 82, 1719
Kavitkar, A. G., 578
Keay, R. W. J., 1634
Kefford, N. P., 1642
Keller, E. R., 790, 1361, 1362
Kendrew, W. G., 995, 996
Kennedy, J. S., 743
Kennedy, W. K., 1203
Kent, N. L., 1136
Kenworthy, J. M., 986
Kenya
  ALDEV, 2028
  Dep. Agric., 1274, 1417, 1575
  E. Afr. Agric., For. Res. Org., 635, 986
  Emp. Cott. Gr. Corp., 326
  Grassl. Res. Sta., Kitale, 1585
Kerr, D., 996
Khan, A. H., 307
Khan, A. R., 618
Khan, M., 1541
Khan Majlis, M. A., 133
Kibe, M. M., 2046
Kibukamusoke, D. E. B., 820
Kijak, G. S., 1046
Kinbacher, E. J., 2050
Kinebuchi, M., 608, 1164
Kipps, M. S., 2079
Kirinde, S. T. W., 1554
Kirkpatrick, H., 404
Kishan Singh Bedi, 17
Kitchin, J. T., 101
Kivinen, P., 702
Kjaer, A., 669
Klapp, E., 1883
Kleinig, C. R., 1456
Klešnin, A. F., 1996
Kliewer, W. M., 1203
Klitsch, R., 2042
Knabe, W., 955
Knetsch, J. L., 1742
Koba, S., 1390
Kobbia, M. T. El, 863
Kockum, S., 650
Koczor, F., 1785
Kodama, T., 808
Kofoed, A. D., 819
Kohnke, H., 2085
Koitzsch, R., 1413
Kok, B., 386
Kökény, B., 1125
Kolbe, W., 1487
Kolk, H., 376
Kommedahl, T., 708
Kondo, G., 969
Kondo, M., 129
Konovalov, I. N., 359
Kooistra, E., 1813
Kooten, A. v., 1813
Korohoda, J., 1993
Koval'skaja, E. M., 1941
Krach, K. E., 2008
Krantz, B. A., 1698
Kretovič, V. I., 1671
Kreyger, J., 161, 1168
Krijthe, N., 1383
Krishnamurthy, A., 1774
Krishnaswamy, N., 1773
Kristensen, E., 500
Kristensen, H. R., 1345
Kristensen, K. J., 365
Kristkalne, S. H., 1788
Krober, O. A., 1804
Krochmal, A., 659
Krotkov, G., 1470
Krug, H., 364, 896
Krüger, W., 1310
Krustyn', A. O., 1118
Krzysh, G., 1702, 1995
Kubo, A., 152, 634
Kugler, W. F., 41, 50, 61
Kühn, F., 1640
Kulkarni, L. G., 1937
Kunar, I. I., 1938
Kuse, G., 369
Kushman, L. J., 297
Kutuzov, G. P., 222
Kuwada, H., 294
Kvifte, G., 480
Labrousse, G., 696
Laforest, G., 2065
Laird, R. J., 34, 36, 92, 1130, 1198, 1721
Laĭter, D. S., 622
Lakon, G., 1348
Lala, Amarnath, 173
Lambert, R. G., 1322
Lampkin, M., 635
Lan, J. Z., 1756
Landgraf, E., 1572
Landw. Hochsch. Hohenheim, 757, 1549
Langwerden, E. J., 244
Laning, E. R., Jr, 102
Lanza, F., 97, 169
Larsen, A., 329
Larson, W. E., 1825
Larter, E. N., 1718
las Casas, E. de, 1202
Laskin, V. P., 1674
Lauciani, E., 462
Laude, H. H., 1124
Laumont, P., 230
la Vega, J. L. de, 1213, 1214
Laverton, S., 1047
Lawrence, J. M., 29, 1555
Lawson, W. A., 1834
Lea, J. D., 821
Leaf, G., 1469
Leafe, E. L., 1163
Leal, C. J., 1212
Lear, B., 214
Leask, D. M. R., 48, 1147
Lebon, J. H. G., 1570
Lee, T. H., 1574
Leh, H.-O., 1951
Leinweber, C. L., 1918, 1919
Le Mare, P. H., 822
Lemon, E. R., 354, 379
Lenger, A., 497
Leonzio, M., 692
Lessels, W. J., 1291
Letelier, A. E., 38
Letnes, A., 1870
Lévêque, L. A., 660
Levi, E., 2004
Lhoste, J., 1051
Liebermann, M., 811
Lillie, D. T., 2012
Lin, C. F., 1449
Linck, A. J., 1322
Lindgren, D. L., 1131, 1132
Linser, H., 39, 577
Lint, M. M. De, 788
Lippert, L. F., 269
Liró, O. L., 1933
Lisanti, L. E., 1978
Listowski, A., 602
Liu, J. S., 689

Livingston, C. H., 1862
Livingston, H. G., 1274
Lizárraga, H. H., 1721
Llavería, B. M., 1360
Llavería, M., 1380
Llosa, B. C., 556
Llovet, M. J., 1654
Lloyd, N. C., 256
Lockhart, J. A., 370
Logan, J. M., 467
Loktev, N. N., 945
Lommez, J., 1565
Long, H., 2018
Longchamp, R., 1730
Longenecker, D. E., 956
Lööf, B., 869
Loomis, R. S., 754
López, C. G., 782
López-Ríoboo, T. F., 1653, 1767
Lo-Ping, T., 1917
Lorch, J., 1589
Lorenzo, J. R., 320
Lourtioux, A., 1952
Lovely, W. G., 1292
Low Temp. Res. Sta., Cambridge, 189
Luca, Y. de, 200
Luchini, R., 186
Lüddecke, F., 2041
Lüdecke, H., 212, 1354
Ludwieg, F. von, 1979
Ludwig, J. W., 75, 1170
Luginbill, P., Jr, 1112
Lugt, C., 1398, 1893
Lunden, A. P., 237
Lyerly, P. J., 956
McAlister, D. F., 1804
McAllister, J. S. V., 765, 800
McConaghy, S., 765
MacConnell, H. M., 750
McCreath, J. B., 938
McDonald, D. J., 694
McDonnell, P. M., 43
McGinnies, W. G., 521
Machado, S. S., 1271
Machin, K. E., 1516
McIlrath, W. J., 1495
Mackey, A., 285, 1875
McKinstry, A. H., 824, 836
Macleod, D. J., 268
McNeal, F. H., 1112
Macpherson, J. F., 582
McWhorter, C. G., 1195
Madec, P., 1387, 1867
Madsen, K. A., 1405
Magnani, M., 1340
Magoon, M. L., 276
Majlis, M. A. Khan, 133
Maksoud, M. A., 772
Malaguti, G., 679
Malato-Beliz, J., 421
Malaya, Federation of. Dep. Agric., 1786, 1894
Malickiĭ, N., 1908
Mallik, A. K., 479
Mancini, E., 1178
Manickavasagar, P., 674
Mann, H. H., 450
Mann, P. J. G., 1877
Manni, M., 1787
Manning, H. L., 820
Mansfeld, K., 88
Mansfeld, R., 1281
Marais, P. G., 897
Marani, A., 849
Marden, J. A., 299
Margara, J., 218, 1828
Marinos, N. G., 925
Markarova, N. A., 358
Markowski, A., 1668
Maroso, G., 1181
Marschner, H., 1715
Marshall, K., 1049
Marshall, T. J., 2087
Martin, H., 523, 1050
Martin, J. E., 581
Martin, P., 1957
Martin, W. J., 1409
Maskell, F. E., 1379
Mason, D. D., 1744, 1807
Matallana, V. J., 613
Mathon, C.-C., 1119
Mathur, B. P., 342
Matsushima, S., 1263
Matthee, J. J., 1215
Mattingley, G. E. G., 1161
Matumura, Y., 139
Matzner, F., 471
Mau-Kong, W., 122
Mauldon, R. G., 1014
May, L. H., 612, 1157
May and Baker, Ltd., 408
Mayer, A. M., 1944
Mazzani, B., 725, 1452
Meade, J. A., 171, 398
Meadly, G. R. W., 914, 915, 1537
Medvedev, Ž. A., 1508, 1939
Meggitt, W. F., 246
Mehrle, D. W., 72
Mehta, B. V., 1942, 1970
Mei, A., 1614
Meier, W., 763
Mei-Hsiang, K., 1916
Meinhold, K., 1617
Menzel, R. G., 1989
Meppelink, E. K., 1099
Mercer, J. H., 2023
Merny, G., 1759
Mertz, E. T., 95
Merwe, J. J. van der, 1305
Mes, M. G., 1326
Mesa, B. D., 89
Met. Off., Wld Climatol. Br., Harrow, 1638
Mexico. Sec. Agric. Ganad., 36, 87, 98, 164, 633, 1198, 1721
Michael-Lusti, J., 2061
Michelson, L. F., 496
Middleton, G. K., 1792
Miettinen, J., 2084
Miller, J. C., 293
Miller, L. I., 1307
Miller, P. A., 1922
Mills, W. T., 1812
Milne-Redhead, E., 524
Milthorpe, F. L., 1548, R.A. p. 1
Ministries of Agriculture — see countries
Minarik, C. E., 946
Miranda, O. J., 1827, 1851
Mirchandani, P. M., 1597
Miroljubov, K. S., 1521
Mishra, D., 682, 1242
Misra, G., 130, 563, 682, 1242
Mitchell, R. L., 384
Mitchell, T. J., 1167
Mitrović, A., 720, 1953
Mitui, Y., 843
Miura, S., 1499
Miyamoto, T., 1403, 1663
Mizuno, S., 1315
Moffatt, J. R., 1791
Mohl, J. S., 1498
Mohrmann, J. C. J., 972, 2034
Moja, A., 20, 935
Molyneux, J., 1753
Monselise, S. P., 1324
Monson, W. G., 932, 933
Montalvo, S. R., 1360
Montanari, V., 2032
Monteith, J. L., 1994, 2048
Mooi, J. C., 224
Moore, T. C., 190
Moosberg, C. A., 1911
Morani, V., 436
Morel, G., 367
Moreno, M. U., 804
Morita, N., 691
Morita, S., 1780
Moriwaki, T., 1255
Moriya, M., 1244
Morland, R. T., 466, 1598
Morocco. Soc. Agric. Maroc, 4, 118, 437
Morozov, V. K., 345
Morris, H. D., 1789
Morris, H. E., 251
Morris, N. J., 727
Morrison, R. I., 888
Morton, J. D., 984
Moser, F. Y., 1524
Mota, F. S., 627, 1169
Mothes, K., 2084
Motwani, V. T., 2
Mou, T. S., 291
Moumm, N., 892
Moursi, M. A., 772, 1899
Mouton, J., 1759
Muckel, D. C., 461
Mühlethaler, P., 394
Mukula, J., 2013
Müller, H. J., 742, 744
Munakata, K., 1491
Munk, H. von, 1977
Münster, J., 257, 1361, 1362
Murakami, Y., 1777
Muramatsu, I., 456
Murata, Y., 1260
Murphy, H. C., 1143
Murphy, R. P., 894
Musgrave, R. B., 1743, 1745
Muskett, A. E., 1447
Mutter, W., 449
Muzik, T. J., 1555
Myers, J. M., 458
Myhre, D. L., 774, 1845
NAAS, 1006, 1291
Nada, I. A. A., 638, 639, 640, 641
Nagai, M., 377
Nagarajan, K. R., 2063
Nagarajan, S. S., 177
Nagata, T., 1299
Nagato, K., 1268
Nagatomo, T., 729, 731
Nair, G. G. K., 1970
Nair, P. D., 1591
Naka, J., 812
Nakagawa, M., 62
Nakai, A., 1491
Nakamura, H., 1453
Nakanishi, H., 814
Namulonge Cott. Res. Sta., 1907, 2064
Nanda, K. K., 103, 1805

Naranjo, P., 2054
Narayanan, T. R., 128
Nat. Conf. Advisors in Agric. Econ., Wagnen/Allgäu, 1615
Nat. Coöp. Aan- en Verkoopv. Landb. Cent. Bur., 1709
Nat. Veg. Res. Sta., Warwick, 2009
Negi, L. S., 668, 1808
Negura, Y., 814
Nelson, D. C., 736
Németh, G., 1997
Netherlands
  Comm. Hydrol. Onderz. T.N.O., 992
  FAO Meet. Hybrid Maize, Wageningen, 1205
  Inst. Biol. Scheik. Onderz. Landb-Gew., Wageningen, 766, 1160, 1284, 1358, 1389, 1398, 1525
  Inst. Bodemvrucht., 1819
  Inst. Cultuurtech. Waterhuis., Wageningen, 1586
  Nat. Coöp. Aan- en Verkoopv. Landb. Cent. Bur., 1709
  Proefsta. Akker. Weidebouw, Wageningen, 600, 733, 1448, 1891, 1923
Neves, O. S., 325
New Zealand
  Austr. N.Z. Ass. Adv. Sci., 2068
  Weed Contr. Conf., 734, 764, 779, 980
Nezamuddin, S., 1172
NIAB, 703, 741, 755, 767, 796, 1096, 1097, 1135, 1151, 1291
NIAE, 280, 580, 588
Nicholson, F. J., 1732
Nicholson, G. E., 308
Ničiporovič, A. A., 870, 871
Nickell, L. G., 371
Niclaes, J., 1316, 1435
Niederhauser, J. S., 1370
Nielsen, K. F., 642
Nielsen, L. W., 1895
Nielsen, V., 1613
Niemann, E., 16
Nieschlag, F., 1884
Nieto, J., 630
Nigeria
  Northern
    Dep. Agric., 1311, 1318, 1412, 1534, 1579
    Emp. Cott. Gr. Corp., 1431
  W. Afr. Maize Res. Unit, 86
Nihsiyama, Y., 1388
Nikolic-Vig, V., 1657
Niles, G. A., 827
Niles, J. J., 1232
Nilsson, B., 1535
Nishikawa, K., 1188, 1264
Nishimura, S., 3
Nissen, Ø, 225, 1727
Nitzsche, M., 1354
Nix, J. S., 1355
Njoku, E., 1782
Noble, M. J., 1015
Noläng, R., 960
Nömmik, H., 882
Nonaka, F., 1237
Nonnecke, I. L., 656
Norden, A. J., 594, 1696, 1697
Norfolk Agric. Sta., Sprowston, 576, 732, 752
Normanha, E. S., 813, 1410
Norris, H. H., 206
North, C., 739
N. Cent. Weed Contr. Conf., USA, 630, 631, 707, 708, 906, 907, 908, 909, 911, 912, 913, 916, 917, 918, 919, 920, 921, 928, 930, 931, 932, 933, 942, 946, 948
N.E. Weed Contr. Conf., USA, 84, 85, 101, 171, 246, 247, 249, 395, 396, 415, 416, 417, 786
N. Scot. Coll. Agric., Econ. Dep., 599
Nottingham Univ., Dep. Agric. Econ., 54, 64, 807, 1002
Novickaja, Ju. E., 66
Novožilov, I. I., 1821
Nowosad, F. S., 1564
Nultsch, W., 282, 1880
Nutman, P. S., 2084
Nutt, J. D., 1406
Nuttonson, M. Y., 1705
Nyasaland. Dep. Agric., 620, 967
Nye, I. W. B., 1607
Nye, P. H., 963
Nylund, R. E., 736
Oakes, A. J., 178
Oberembt, E., 236
Oberholzer, J. J., 1215
Obolensky, G., 63
Obregon, F., 1183
Odell, R. T., 1722
Odumanova, G. A., 1465
OEEC, 454, 1008, 1605, 2067
Ohlrogge, A. J., 1191
Oka, H. I., 1256
Okamoto, Y., 1265
O'Keefe, R. B., 1848, 1879
Olan, V. R., 290
Oliveira, A. J. de, 1012
Ollagnier, M., 181
Olsson, G., 868
Oltmann, W., 1793
Omar, M. A., 619
O'Neil, J. M., 401, 934
Ophuis, B. G., 1395
Opsahl, B., 1414
Orchard, B., 1836, 1981
Ordoveza, J. L., 78
Orlando, A., 1381
Orsini, F. F. N., 900
Ortmann, C., 784
Osborne, D. J., 1955
Osborne, L. W., 146
Oshima, E., 1349
Osler, R. D., 1183, 1184, 1214
O'Sullivan, T. J. R., 221
Ōta, Y., 685, 1245
Owen, P. C., 219, 1351
Oxley, T. A., 505
Oyama, K., 686
Pacif. Sci. Bd, 427, 481
Pack, M. R., 324
Padaki, G. R., 1422
Palacios, G., 1184
Palmer, J. H., 905
Palmer-Jones, T., 2062
Pané, M. J., 1100
Panenko, I. D., 1846
Panos, D. A., 2043
Pao-Kuei, W., 1667
Parencia, C. R., 1427
Parisinos, J. C., 864
Parker, F. W., 1590
Parks, W. L., 1742
Parsons, W. T., 400, 402, 1536
Parthasarathy, N., 699
Pasquale, D. R., 1339
Passlow, T., 108, 839
Passmore, R. G., 821
Pate, J. S., 191, 1329, 1642
Patel, C. T., 840
Pathak, C. H., 1731
Patil, J. A., 554
Patil, S. S., 676
Paton, D. M., 1642
Patrucco, G., 661
Patterson, H. D., 2038
Pauli, A. W., 1124
Paunero, E., 593
Pavličič, J., 1953
Pawlik, A., 1549
Pazourek, J., 344
Pea-growing Res. Org. Ltd., 192
Pearce, D. G., 1062
Pearce, G. A., 1320
Pearson, E. O., 1048
Pearson, G. A., 1798
Peken'o, P. H., 1683
Pelerents, C., 1248
Pelton, W. L., 988
Penman, H. L., 1055
Pennacchiotti, M. I., 96
Penny, A., 1799
Péquart, S.-J., 1889
Pereira, H. C., 457
Perennec, P., 1867
Pérez, M. J. E., 1371
Pérez-Navarro, A., 613
Perkins, H. F., 1701
Persson, A. R., 366
Persson, B., 868
Persson, P., 589
Peru
  La Molina Esta. Exp. Agríc., 1434
  Minist. Agric., Div. Exp. Agric., 1272, 1418
Pesola, V. A., 1652
Pessi, Y., 702
Peters, D. B., 1196
Petersen, H. I., 1489
Petinov, N. S., 876, 877, 879
Petri, P. Scaramella, 794
Pfeffer, C., 1871
Pfeiffer, R. K., 2015
Philip, J. R., 1472, 1473, 1474
Philipp, L., 31
Phillips, R. W., 698
Photiades, T., 2003
Piacco, R., 119, 1238, 1769
Picard, J., 195, 435
Pichler, F., 1108
Pierson, C., 104
Pilet, P.-E., 201
Pimentel, H., 8
Piot, R., 597
Pirie, N. W., 1055
Pirttilä, H., 2013
Plaisted, P. H., 1437
Plant Breed. Sta., Lemberge, 1021
Plant Prot. Ltd., 1488
Pleshkov, B. P., 1714
Podol'skiĭ, A. S., 987
Pohjanheimo, O., 1676, 1790
Poljanovskiĭ, O. L., 1671
Pohlendt, G., 26
Poland. Inst. Pl. Breed., Acad. Sci., 1074
Pollard, A. G., 441, 442

Pommer, J., 1572
Ponnamperuma, F. N., 1784
Porcelli, S., 1341
Portères, R., 151, 1220
Postel, W., 798
Potato Ass. Amer., Meet., 1845, 1848, 1858, 1859, 1862, 1864, 1878, 1879
Potter, C., 561
Power, J. F., 546
Prasad, L. K., 1172
Presley, J. T., 317
Prettenhoffer, I., 1785
Prevot, P., 181, 1306
Prieto, H. E., 1653
Primost, E., 39, 715, 1126, 1149
Prinzi, D., 433
Proctor, J. M., 185
Proefsta. Akker. Weidebouw, Netherlands, 600, 733, 1448, 1891, 1923
Prummel, J., 802
Prytherch, E. I., 1359, 1902
Puerta, F. de la, 80
Puerta, R. J., 1295
Pugnat, C., 1796
Purdy, L. H., 591
Purss, G. S., 166
Putt, E. D., 346
Puttarudriah, M., 127
Quebec Soc. Protect. Pl., 655, 785
Queensland Univ. Dep. Agric., 1210, 1211
Quemener, J., 1407
Quidet, P., 1885
Raadsma, S., 990
Ráb, Fr., 1640
Racovitza, A., 1546
Radley, M., 1713
Raes, G., 1436
Raéz, J. L., 1272
Raheja, P. C., 494
Rahmann, M., 1204
Raidt, W., 1843
Rajagopalan, K., 684
Ram, C. S. V., 1776
Raman, V. S., 175, 176, 177
Ramaswami, V., 321
Ramírez, G. M., 164
Ramos, M. D. de, 1270
Ramshorn, K., 1817
Randhawa, M. S., 1057
Ranghino, F., 1269
Rao, K. B., 137
Rao, P. N. A., 110
Rapin, J., 1347
Rappaport, L., 267
Raski, D. J., 214
Rasulev, A., 1578
Raw, F., 561
Rawat, V. S., 943
Rea, H. E., 919, 1531
Rees, A. M. M., 962
Reestman, A. J., 1891
Reggiani, F., 1209
Rego, Z. J. P. C., 973
Reichert, R., 791
Reid, D. A., 57
Reid, I. G., 964
Reiss, B. C. R., 1648
Reith, J. W. S., 799
Relwani, L. L., 555
Renfro, G. M., Jr, 971
Repp, G., 1556
Resch, A., 1818
Revilla, M. V., 1425
Revilla, V. A., 1377
Reynolds, H. T., 311
Reynolds, H. W., 314
Reyntens, H., 1021
Rhodesia and Nyasaland, Fed. of
N. Rhodesia. Dep. Agric., 962, 1747
Sec. Fed. Minist. Agric., 617, 643, 824, 836, 977
S. Rhodesia. Salisbury Agric. Exp. Sta., 1199
Richards, A. I., 2022
Rico, M. E., 1153
Rid, H., 70
Riddell, J. A., 1666
Ridyard, H. N., 28
Riepma Wzn, P., 194, 733, 1814
Rietberg, H., 209
Rigot, N., 238
Riley, G. B., 87
Riley, W. F., 1492
Ripper, W. E., 211
Riso, 665
Rivero, J. M. del, 1428
Rivett, A. D., 1649
Rivière, J., 1669
Roberts, E., 950
Roberts, H. A., 2009
Roberts, L. M., 1186
Robertson, G. W., 898
Robertson, R. A., 434
Robertson, W. K., 645, 1007
Robinson, D. H., 545
Robinson, E. P., 1599
Robinson, R. G., 1369
Robyns, W., 1053
Roche, J., 2030
Rochecouste, E., 1533
Rodriguez, G. A., 1197
Rodriguez, R. A., 1378
Rodriguez-Arias, J. H., 648, 1200
Roer, L., 237
Rogers, J. S., 1194
Rojas, G. M., 560
Romano, E., 79
Romanovskii, B., 1910
Romney, E. M., 1988, 1991
Rosbaco, U., 1208
Rossiter, R. C., 540
Rothamsted Exp. Sta., 1006, 1660, 1661, 1791, 1799, 1816, 1830, 1832, 1836, 1857, 1877, 1954, 1959, 1963, 1981, 1994, 1999, 2010, 2038, 2039, 2048, 2058
Rothwell, D. F., 880
Roy, S. K., 1764
Roy. Comm. Common Ld, England and Wales, 954, 1636
Rumbaugh, M. D., 1724
Runeckles, V. C., 569
Runge, E. C. A., 1722
Ruschke, U., 1843
Russell, G. C., 33
Russell, I., 1584, 1595
Russell, M. B., 1196
Russell, R. C., 1154
Russell, R. S., 390, 391, 902
Ryan, F. E., 596, 982, 1444, 1445
Ryssdal, J., 1287
Šabalin, I. N., 2037
Sacco, J. da C., 929
Sachet, M.-H., 481
Sackston, W. E., 1454
Sado, T., 1775, 1783
Sahu, G., 130
Saidak, W. K., 395
Saini, S. S., 668
Salazar, V. Q. J., 1
Saldarriaga, A., 1201
Salisbury Agric. Exp. Sta., 1199
Salmond, K. F., 1747
Salunkhe, D. K., 1405, 1524, 1901
Sampath, S., 680
Samuels, D. E. J., 851, 852
San'-Cen', Sun', 23
Sánchez, D. N., 98
Šandera, K., 217
Sanders, H. G., 430, 1055, 1056
Sandison, A., 1802, 1998
Sansom, T. K., 617
Santareno, J. A. L. M., 424
Santelmann, P. W., 171, 398
Šardakov, V. S., 1905
Sarić, M., 1090
Sarker, A. K., 1936
Sartori, G. A., 1357
Sasaki, N., 683
Sasamura, S., 1300
Sasser, J. N., 1895
Sasso, G., 549, 550, 626
Satchell, J. E., 1018
Šatilov, I. S., 1739
Sato, I., 114
Sato, S., 1244
Sato, T., 1246, 1453
Savile, A. H., 202, 302, 350
Sawada, E., 1898
Sawyer, R. L., 247, 286, 1399
Sayed, M. D., 585
Scaramella Petri, P., 794
Schachl, M., 32
Schaeffler, H., 220
Schaik, T. van, 1728
Schallock, D. A., 159
Schapper, H. P., 540
Schechter, M. S., 890
Schelling, P., 1709
Schiff, L., 461
Schilling, G., 1635
Schippers, P. A., 235
Scheusener, H., 1884
Schmalz, H., 565
Schmerbauch, R. P., 930
Schmitt, L., 160, 493
Schmitz, G., 312
Schnee, M., 1011
Schnell, R., 2080
Scholte Ubing, D. W., 778
Schoor, G. H. J. van, 1961
Schribaux, P., 163
Schröder, —, 1843
Schultz, R. E., 916
Schulz, K., 197, 1413
Schulze, E., 780
Schuphan, W., 797, 798
Schütte, K. H., 1957
Schütz, E., 1523
Schuylenborgh, J. van, 1778
Schwab, G. O., 624
Schwarz, W., 242
Schwimmer, S., 266
Scott, L. E., 295
Scott, P., 2023
Scott, R. O., 384
Seatz, L. F., 93
Šebánek, J., 1640
Seed World, 1293

Seeger, J., 1331
Seguela, J.-M., 1662
Seischab, —, 1884
Sekiya, F., 1247
Sekizuka, S., 1328
Selke, W., 52
Selleck, G. W., 418
Semenenko, V. E., 1512
Sementi elette, 783, 1103, 1241
Semere, S., 273
Sen, P. K., 1936
Serrano, P. J. L., 560
Shafer, N. E., 932, 933
Shalhevet, J., 94
Shaligram, G. C., 1439
Shannon, L. M., 1498
Sharma, M. K., 1397
Shaw, M., 21
Shaw, R. H., 1694, 1736
Shear, G. M., 1307
Sheard, R. W., 1876
Shebeski, L. H., 1540
Sheets, T. J., 1560
Sheldon, W. H., 716
Shell Chem. Co., Ltd., 2081
Shepherd, R. W., 1823
Shibuya, T., 1250
Shiratori, K., 1239
Short, J. L., 1840
Shu-Veng, Y., 1781
Sidhu, H. S., 348
Sidoryk, S., 1866
Sierra Leone. W. Afr. Rice Res. Sta., Rokupr, 671
Sikka, S. M., 10, 1658
Silberstein, L., 1969
Silenko, Z. V., 548
Silow, R. A., 901, 1522
Silva, H. L., 2021
Silvestre, P., 746
Sim, J. T. R., 1327
Simkins, C. A., 1680
Simlote, K. M., 1438
Simmons, K. V., 105
Šimon, J., 1640
Simon, J. E., 1380
Simon, U., 351
Simon, W., 1582
Simonneau, P., 1223
Simons, D., 805
Simór, P., 330
Šin-Cin, 826
Singh, A., 17
Singh, D., 174, 199, 1934
Singh, D. N., 174
Singh, G., 11
Singh, K., 441, 442
Singh, M. P., 173, 1809
Singh, S., 348, 1430, 1438
Single, W. V., 1121, 1122
Singleton, W. R., 528
Sisakjan, N. M., 1350, 1992
Sivadjian, J., 1313
Sivaraman, M. S., 978
Sivokonev, A. N., 1457
Skaland, N., 225, 1727
Skazkin, F. D., 1797
Skerman, P. J., 1210, 1211
Skinner, T. C., 458
Skok, J., 1495
Škol'nik, M. Ja., 358, 1481
Skoog, F. E., 1113
Slaats, M., 2006
Slatyer, R. O. 381
Slavík, B., 353
Sless, J. B., 469
Slife, F. W., 631, 930
Smart, E. F., 540
Smart, H. F., 1400
Smedgård, G., 592, 1376
Smith, C. S., 279
Smith, R. J., 1771
Smith, S. R., 2017
Smith, T. F., 1187
Smith, W., 530
Smith, W. L., Jr, 1400
Soares, R. N. G., 445
Soc. Agric. Maroc., 4, 118
Soc. Encourage. Cult. Orges Brass. Houbl. Fr., 59
Soc. Exp. Biol., Gt Britain, 2084
Soil and Crop Sci. Soc. Fla, 458
Soil Surv. Gt Britain, 950
Sokolov, U. S., 2084
Soll, H.-H., 1884
Somorowska, K., 1868
Soper, M. H. R., 193, 505
Sørensen, C., 1700
Sorenson, J. W., 1218
Soroa, P. J. M., 1455
South Africa, Union of. Dep. Agric., Div. Econ. Mkts, 654
Spain
Cent. Cerealicult., Madrid, 613
Esta. Rieg. Córdoba, 625, 854, 855
Minist. Agric., 1, 1933
Sparks, W. C., 263, 1878
Specht, G., 1173
Spence, J. R., 1442
Spencer, F. M., 1171, 1584, 1595
Spreafico, L., 891, 935
Spurrier, E. C., 948
Squire, H. M., 391
Srinivasan, V. K., 10
Srivastava, M. G., 1236
Sta. Chim.-agr., Roma, 79, 169
Stamp, L. D., 430, 1055, 1569, 1636
Stanhill, G., 1517
Staniforth, D. W., 630
Stanton, W. R., 1216
Stanway, V., 1755
Stapel, C., 1494
Stat. Forsøgsvirk. Plantekult., Denmark, 735, 1098, 1138
Stat. JordbrFörsök, Sweden, 789
Steenbjerg, F., 495
Štefl, J., 1640
Steinbauer, G. P., 920
Steineck, O., 233
Stelly, M., 1701
Stenseth, C., 769
Stenuit, D., 597
Stepanov, V. N., 1739
Stern, W. R., 724
Steveninck, R. F. M. van, 1820
Steward, A. N., 1054
Steward, F. C., 2084
Stewart, B. A., 598, 1682
Steyvoort, L. van, 1343, 1344, 1632
Stickler, F. C., 621
Stino, K. R., 810
Stoa, T. E., 704
Stockman, J., 285
Stokes, I. E., 107
Stoneman, T. C., 438
Stottmeister, W., 243
Stowe, B. B., 1950
Stracke, W., 210
Strateń, I. von der, 68
Strebeyko, P., 1971
Stritesky, A., 220
Strogonova, L. E., 871
Strong, R. G., 1132
Stroun, M., 154, 713, 1796
Strusi, A., 27
Struve, W. M., 1746
Stryckers, J., 949, 1285, 1551, 2006, 2014
Stubbs, J., 1558
Suarez de Castro, F., 1197
Subido, P. S., 141
Sugawara, K., 584
Sugino, M., 1673
Suikerbiet, 215, 753
Šul'gin, I. A., 1983, 1996
Sulzer, J.-P., 1129
Summers, T. E., 337
Sun, C. N., 1298, 1304
Sun-Chan, Y., 122
Surinam. Agric. Res. Sta., 677
Süss, A., 70
Sutcliffe, J. F., 1964
Šu-Ven', Ju., 1675
Suzuki, S., 1775
Sváb, J., 1013
Svensson, B., 789
Sweden. Stat. JordbrFörsök, 789
Sweet, R. D., 416
Sykes, J. D., 1001
Symes, K. J., 12, 13
Symp. Biol. Prod. Brit., London, 430
Symp. Fodder Pl., Polish Acad. Sci., 1074
Symp. Util. Nitrogen, Reading, 2084
Szeicz, G., 1994, 2048
Tagawa, T., 1388
Takahashi, J., 1253
Takata, H., 140
Tallon, G., 670
Tamaki, K., 812
Tambs-Lyche, H., 743
Tamm, E., 1995
Tanaka, A., 132
Tanaka, S., 1779
Tanaka, Y., 456
Tang, P. S., 687
Tang, S. H., 689
Tanganyika
Agric. Corp., 615, 718, 723, 968, 976
Dep. Agric., 1171, 1584, 1595
Taniguti, S., 2035
Tanner, C. B., 385
Tanner, R. E. E., 453
Tasmania. Dep. Agric., 1321, 1385, 1553
Taya, N., 691
Tayel, M. A., 1899
Taylor, J. A., 1060, 1603
Taylor, R. L., 412
Taylor, T. H. A., 540
Tejwani, K. G., 1754
Tella, R., 726
Téllez, M. R., 553
Tempe, J. de, 150, 850
ten Boer, H., 1855
ten Have, H., 695, 1226
ter Horst, K., 717, 1309
Terra, G. J. A., 959
Terregino, S., 1334
Terre maroc., 422
Ter-Saakjan, T. S., 229
Thellier, M., 1976

Thevan, P. V., 1243
Thielebein, M., 1335
Thijn, G. A., 1863
Thomas, M., 1594
Thompson, E. G., 207
Thompson, F. B., 764
Thompson, L., 1751
Thompson, N. R., 1401, 1869
Thompson, R. K., 1134
Thorne, G. N., 392
Thornthwaite, C. W., 2049
Thornton, B. J., 2005
Thorpe, H. C., 9, 1105, 1279
Thurston, J. M., 1999
Tiddell, T. F., 786
Tihonova, N. A., 1711
Tilemans, E. M., 2059
Timm, H., 1873
Timmons, F. L., 1539
Tinarelli, A., 1231
Tison, J., 521
Todd, G. W., 1464
Toderi, G., 1656
Togari, Y., 1262
Tokuoka, M., 1779
Tolbert, N. E., 1519, 1520
Toms, A. M., 1429
Toms, J., 42
Topušseva, N., 1910
Torssel, B., 1459, R.A. p. 169
Tourneur, M., 1325
Touvin, H., 1828
Trentin, A., 1101, 1180
Trevett, M. F., 248, 249
Trop. Prod. Inst., London, 1065
Troupin, G., 1567
Tsing-Hai, C., 310
Tsotsis, B., 1738
Tu, D. S., 335
Tung-Fang, C., 1665
Tunnell, G. A., 1601
Turner, R., 979
Turrill, W. B., 524
Tuttle, D. M., 1433
Ubing, D. W. Scholte, 778
Ueda, H., 686
Uehara, M., 472
Uganda
  Emp. Cott. Gr. Corp., 820, 821, 822, 823, 831, 835, 841, 842
  Namulonge Cott. Res. Sta., 1907, 2064
Uhrecký, I., 1640
Ullrich, H., 360
Umaerus, V., 1852
Umali, D. L., 123, 142
UNESCO
  Adv. Cttee Arid Zone Res., 521
  Internat. Conf. Radioisot., Paris, 1058
Union of S. Africa — see South Africa
United Nations — see also UNESCO above
  Terminol. Sect., 1059
Univ. Coll. Wales, Aberystwyth, 1010, 1603
Urano, K., 1189, 1301
USA
  Alaska Univ. Agric. Ext. Serv., 412
  Chinese-Amer. Joint Comm. Rural Reconstr. Pl. Industr., 443
  Conf. Phys. Cloud and Precipit. Part., Mass., 1955, 530
  Dep. Agric., 57, 107, 198, 981, 1609
  Dep. Comm., Nat. Bur. Standards, 388
  Florida
    Soil and Crop Sci. Fla, 458
    Univ. Agric. Exp. Sta., 73
  Illinois Univ. Agric. Ext. Serv., 590
  Iowa Agric. Exp. Sta., 624
  Kentucky Agric. Exp. Sta., 170
  Montana Agric. Exp. Sta., 251, 1825
  New Mexico Agric. Exp. Sta., 289, 323, 324, 1912
  N. Carolina Agric. Exp. Sta., 581, 1792, 1812
  N. Cent. Weed Contr. Conf., 630, 631, 707, 708, 906, 907, 908, 909, 911, 912, 913, 916, 917, 918, 919, 920, 921, 928, 930, 931, 932, 933, 942, 946, 948
  N. Dakota Agric. Coll. Ext. Serv., 704, 719, 936, 1016
  N.E. Weed Contr. Conf., 84, 85, 101, 171, 246, 247, 249, 395, 396, 415, 416, 417, 786
  Oklahoma Agric. Exp. Sta., 598
  Potato Ass. Amer., Meet., 1845, 1848, 1858, 1859, 1862, 1864, 1878, 1879
  Purdue Univ. Agric. Exp. Sta., 147
  Texas Agric. Exp. Sta., 827, 956, 1218, 1531
  Washington Inst. Agric. Sci., 81
  Wyoming Agric. Exp. Sta., 758
Usman, S., 127
USSR
  Acad. Sci., Moscow, 870
  All-Union Sci. Inst. Cott. Res., Taškent, 1440
  Uzbek Acad. Agric. Sci., Taškent, 1440
Uzumaki, M., 472
Valdeyron, G., 1662
Valle, E., 795
Valmari, A., 1800
van Aartsen, J. P., 428
van Alphen, T. G., 1965
Vandecaveye, S. C., 323
Vanden Born, W. H., 922, 923
van der Merwe, J. J., 1305
van der Veen, R., 361
van der Want, J. P. H., 747
van der Zaag, D. E., 781, 1891
van Dobben, W. H., 1160, 1284, 1286
van Dord, D. C., 2000
van Dyk, G. J., 452
van Eijnattan, C. L. M., 86
van Emden, J. H., 253
Vanetti, F., 196
van Schaik, T., 1728
van Schoor, G. H. J., 1961
van Schuylenborgh, J., 1778
Van Steveninck, R. F. M., 1475, 1820
van Steyvoort, L., 1343, 1344, 1632
van Wambeke, A., 1571
Vargas, B. A., 1235
Varis, A. L., 1831
Varis, E., 1704
Varma, K. R., 860
Vasil'ev, I. M., 1467
Vear, K. C., 522
Veatch, C., 84, 396
Veen, R. van der, 361
Veenbaas, A., 1814
Vega, J. L. de la, 1213, 1214
Velasco, E. E., 1120
Velasco, J. R., 125, 131
Velásquez, L. J., 1421
Vellard, J., 1837
Venkatrao, S., 658
Verdejo, G., 368
Verdejo, V. G., 1557
Verma, R. D., 1144, 1552
Vernon, R. O., 458
Vet. Univ. Buenos Aires, Fac. Agric., 900
Viado, G. B., 76
Viali, G., 1228
Vidal, A. A., 1822
Vidal, P., 1596
Villanueva, R., 556
Virtanen, A. I., 601, 738, 889
Visser, W. C., 1479
Vittum, M. T., 1319
Vlasjuk, P. A., 1968, 2036
Vogler, E., 1128
Vogt, —, 1843
Vollema, J. S., 117
van der Straten, I., 68
van Ludwieg, F. von, 1979
von Munk, H., 1977
Voskresenskaja, N. P., 1478
Wachtel, T., 803
Wada, G., 1263
Waddle, B. A., 1911
Wadsworth, R. M., 1484
Wahhab, A., 1921
Waite Agric. Res. Inst., 547, 609, 612, 1505
Walkden Brown, C., 1687
Walker, H. G., 673
Walker, R. L., 1432
Wallace, A., 1193, 1498, 1960
Wallace, R. H., 1458
Wallen, C. C., 2051
Waller, —, 1146
Walsh, T., 43
Walter, C., 1761
Walton, P. D., 823
Wambeke, A. van, 1571
Wang, T. P., 1853
Want, J. P. H. van der, 747
Ward, G. M., 567
Waring, S. A., 1093
Waris, H., 375
Warley, T., 807
Warmbrunn, K., 1659
Warren, G. C., 1841
Warren, R. G., 1963, 2039
Washington Inst. Agric. Sci., 81
Wassink, E. C., 389
Watanabe, K., 153
Watkinson, J. H., 383
Watson, D. J., 65, 1055
Watson, K. A., 1318, 1412, 1534, 1579
Wauthy, R., 208, 1342
Way, M. J., 1816, 2058
Webb, R. A., 886
Webber, G. D., 604
Weber, C. R., 1294
Weibel, D. E., 1109
Weickmann, H., 530
Weissman, G. S., 1670
Welbank, P. J., 2010
Wellhausen, E. J., 633
Wells, D. G., 1987
Welsh Pl. Breed Sta., Aberystwyth, 47
Wene, G. P., 1433
Wen-Kwei, P., 690
Wensley, G. L., 417

Went, F. W., 1324, 1874
Werner, H. O., 1864, 1879
Werner, W., 1884
W. Afr. Res. Unit, Rokupr, 86, 671
W. Afr. Stand. Adv. Cttee, 1023
West Indies. British. Emp. Cott. Gr. Corp., 327, 1442
W. Scot. Agric. Coll., 938
Western Samoa. Dep. Agric. Fish., For., 301
Westmoreland, W. G., 942
Weston, W. J., 266
Westrate, W., 55
Wheeler, A. W., 1954
White, H. B., 318
White, W. J., 347
Whitehouse, J., 1718
Whiteside, A. G. O., 6
Whitney, W. K., 1288
Whitrow, M., 1009
Whittington, W. J., 1958
Whyte, R. O., 521
Wiant, D. E., 1506
Wibberley, G. P., 430, 1055
Wickens, G. M., 831
Widdowson, F. V., 492, 1161, 1165, 1799
Wiebe, G. A., 57
Wiegand, C. L., 354
Wiersum, L. K., 899, 1974
Wiese, A. F., 919
Wiggans, S. C., 1694, 1695, 1699
Wikramanayake, V. E. A., 1592
Wilcox, G. E., 1606
Wilcox, M. S., 292
Wilkens, W. F., 1858
Willey, L. A., 893, 1177, 1720, 1725, 1826
Williams, B. C., 323
Williams, P. C., 45
Williams, R. F., 1642
Williamson, R. E., 872
Willimott, S. G., 1221
Willits, N. A., 1518
Wilson, A. R., 1404
Wilson, J. H., 776
Wilson, T. B., 700
Wilson, W. T., 475
Wilson-Jones, K., 941
Wiltse, M. G., 721
Wind Hzn, R., 992
Winfield, A. L., 1462
Winner, C., 212
Winzer, K., 1615
Wit, C. T. de, 1225, 1525, 1940
Wittwer, S. H., 873
Wofford, I. M., 74
Wolfe, J. S., 439
Wolfe, T. K., 2079
Wood, I. J. L., 1419
Woodford, E. K., 2011
Woolley, J. T., 357
World Congr. Agric. Res., Rome, 1801, 1883, 2044
World Crops, 430
Worthington, E. B., 2082
Wressell, H. B., 1207
Wright, W. A., 202, 302, 350
Wu, H. Y., 687
Wu, W., 1803
Wüst, E., 1114
Wuth, E., 53
Wyatt, R. E., 1311
Wybenga, J. M., 387
Wye Coll., 953, 964, 1001, 1022
Yabuki, K., 113
Yamada, I., 1254
Yamada, N., 685, 1245
Yamagata, M., 1251, 1258, 1259
Yamaguchi, H., 693
Yamaki, T., 1950
Yamamoto, F., 489
Yamamoto, K., 294
Yamamoto, S., 1107
Yapp, W. B., 1055
Yates, R. A., 1060
Yokota, R., 446, 447
Yoshida, S., 1261
Yoshida, T., 1253
Yoshii, H., 1107
Yoshiyama, T., 1328
Younger, R. R., 406
Younts, S. E., 1743, 1745
Yu-Ching, W., 1943
Yü-Ruey, Y., 690
Yu-Wen, L., 1930
Zaag, D. E. van der, 781, 1891
Zabluda, G. V., 1847
Žák, J., 1640
Zanini, E., 1337, 1338
Zeumer, H., 1611
Ziffer, —, 1884
Zilke, S., 918
Zill, L. P., 1520
Zingg, A. W., 2047
Žo-Fu, Du, 24
Zogg, H., 188, 711
Zoller, R. B., 1618
Zonderwijk, P., 2000
Zubeldia, L. A., 782
Zucchini, I., 1182
Zwerman, P. J., 94

CAMBRIAN NEWS (ABERYSTWYTH) LTD.